premio

Your Success,
Our Commitment

INDUSTRIAL EMBEDDED SYSTEMS

RUGGED EDGE SYSTEMS ADVANCE DATA-HEAVY RAILWAY APPLICATIONS

Robust industrial computing optimizes railway signaling and real-time surveillance applications

The Challenge

- Replace an existing tier-one provider's 2U 19-inch rackmount system with a smarter space-saving design while upgrading to next generation performance for advanced railway signaling

- Leverage the rugged high performance of a fanless embedded computing solution for railway signaling infrastructure

- Avoid extended engineering costs and development timelines associated with rugged in-vehicle design

- Maintain an effective EN-50155 certification process, meeting railway standards while shrinking customary 18 to 24 month time-to-market

- Embrace more sophisticated edge computing that anticipates steadily increasing data processing requirements for performance and longevity

- Extend the value of railway signaling upgrade investments across additional critical train-borne applications such as real-time surveillance

The Solution

- Renew system infrastructure through agile technology partnership with Premio, tapping its 30 years of design, manufacturing and support for rugged computing applications

- Industrial product focus and deep vertical market understanding honed by real-world expertise in customizing designs for railway deployment

- Premio's ACO-6000 series of rugged, fanless embedded computers; pre-certified systems for fast customization and deployment

- Modular LAN/PoE daughterboard customized to meet strict isolation and EMI standards

- Pre-validated to rolling stock and railway computing standards EN50155/50121-3-2/EN 50121-4/IS402 6th and 7th Gen Intel® Core™ performance featuring TPM 2.0 for advanced security

- Up to 16 PoE ports for flexible performance and exceptional data transmission

ACO-6000-4L

THE BENEFIT

- Capitalize on edge computing and rugged, fanless COTS-based PCs supported by Premio's robust engineering and proven manufacturing quality

- More than 300 railway signaling and rugged NVR systems developed and deployed within nine months, based on speedy customization of pre-validated, turnkey systems certified for rugged performance and standards compliance

- Gain competitive advantage and reduce time-to-market based on effective standards review led by Premio experts

- Process big data close to its source of origination, reducing reliance on cloud resources that add network complexity and latency

- Access IP camera advancements such as improved resolution and frame rates without being hobbled by the corresponding sizable increase in data payload

- Position for exponential future growth of data and edge processing needs of train-borne applications

- Ensure long-term competitive leadership, differentiating solutions with scalable, white glove design and manufacturing services unavailable from a tier one provider

The Company

The customer featured here is a leading global railway solution provider with offices in more than 50 countries offering a comprehensive portfolio in rolling stock, infrastructure, railway signaling, digital mobility, components and related services. Convenience, safety and reliability are at the heart of all its railway systems, informing modern design strategies that feature next generation performance and effective data handling at the rugged edge.

Ruggedized Computing for Railway Signaling

Embedded fanless computing adds reliable value to railway signaling infrastructure

Rolling stock computing systems are complex and mission-critical by nature, with railway signaling standing out as the key to freight and passenger trains moving safely around the rail network. Latency-free data handling is crucial, with significant amounts of data transmitting reliably and efficiently between rail vehicles and railway control hubs. These sophisticated traffic management systems keep rail cars a safe distance from one another, allow time for sufficient braking, and control rail operations that determine the position and safe path of trains.
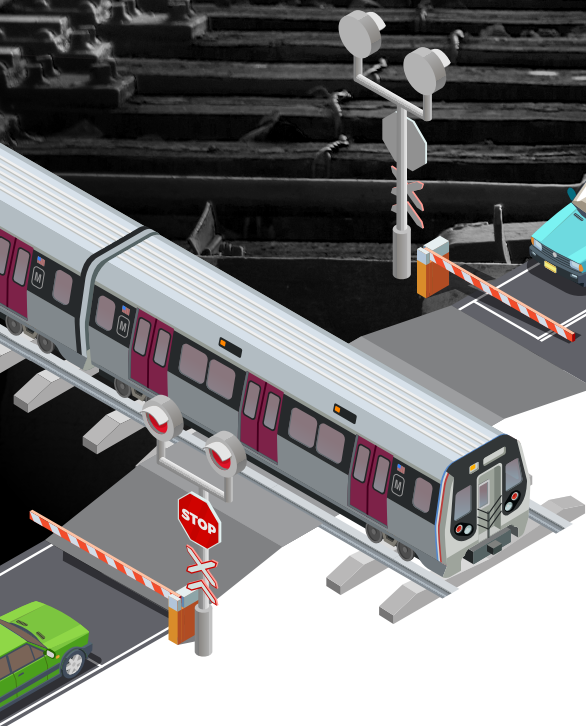
Why Premio?

- Pre-validated to rolling stock and railway computing standards EN50155/50121-3-2/EN 50121-4/IS402

- Modular LAN/PoE daughterboard customized to meet strict isolation and EMI standards

- Premio's ACO-6000 rugged, fanless embedded computers; pre-certified systems for fast customization and deployment for railway

THE CHALLENGE

As part of its ongoing renewal of infrastructure technologies, a global railway leader sought to upgrade its railway signaling system, deployed as a 2U 19-inch rackmount system with train-borne installation. Long-deployed and proven, the railway signaling system had been developed from the ground up. The company had sourced every component – building the chassis, integrating the motherboard – and took the system through an 18 to 24 month certification process. To upgrade performance, a similar extended timeline was just too steep a trade-off, making clear the need for smarter and more competitive options.
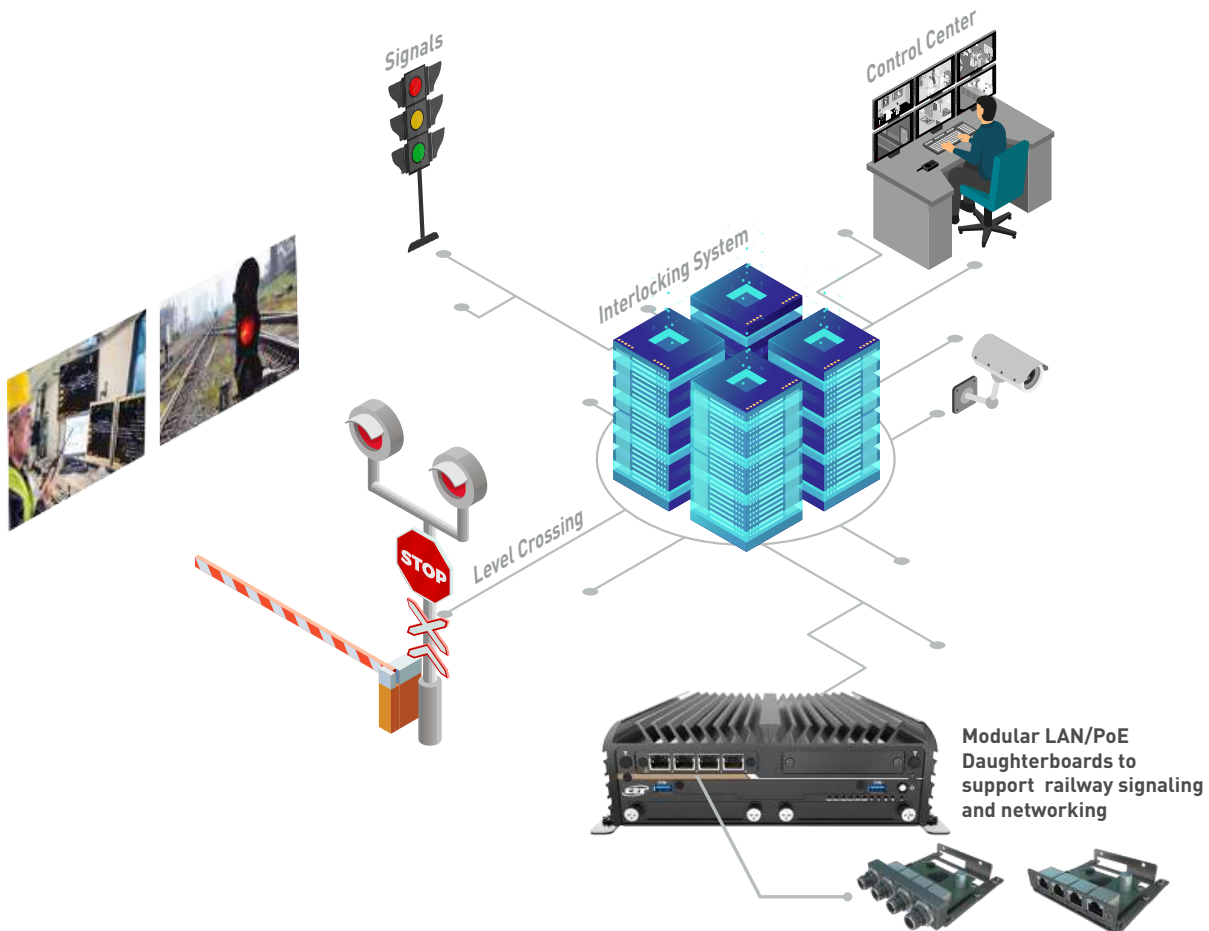
Modular LAN/PoE Daughterboards to support railway signaling and networking

## Embedded fanless computing adds reliable value to railway signaling infrastructure

Railway signaling is communication-based train control, powering the safe and efficient management of freight and passenger trains across the rail network. Automated communication between trains and control hubs routes vehicles to correct tracks and platforms, protects braking distances, and pinpoints train location and speed as part of a centralized system. In this complex network of equipment, embedded fanless systems play a critical role by enabling reliability, serviceability, and scalability.

These rugged, high performance systems manage train operations by handling complex algorithmic timetables. Performance is workload-consolidated, supported by robust compute power as well as a broad spectrum of communications ports for ideal train control operations. While timetables and tolerances are pre-programmed into the network, Premio's advanced fanless embedded box helps achieve low MTBF – ultimately ensuring greater reliability in moving railway applications. Each ACO-60004L acts as a communication node, featuring a 4-port LAN module for train control and communication with built-in protection functions designed to meet strict railway safety and compliance regulations. Not only does this create advantages in compute power, it ensures resilience to environmental challenges such as wide operating temperatures and resistance to shock and vibration. This approach also ensures competitive value and longevity of systems, as strict compliance and pre-validated tests ensure efficient upgrades and retrofits with minimal development and certification time.

Increasing the value of rugged edge computing

At the same time, the company wanted to advance its railway signaling capabilities with a more modern approach centered on exceptional data handling at the data source, creating a rugged edge device that would outperform previous products. Such a device would have potential beyond critical railway signaling and could advance other data-heavy railway applications including real-time surveillance powered by network video recorders (NVRs). Ruggedness would be key here, blending the physical and logistical challenges of volatile rolling stock environments with effectively balancing critical data workloads.
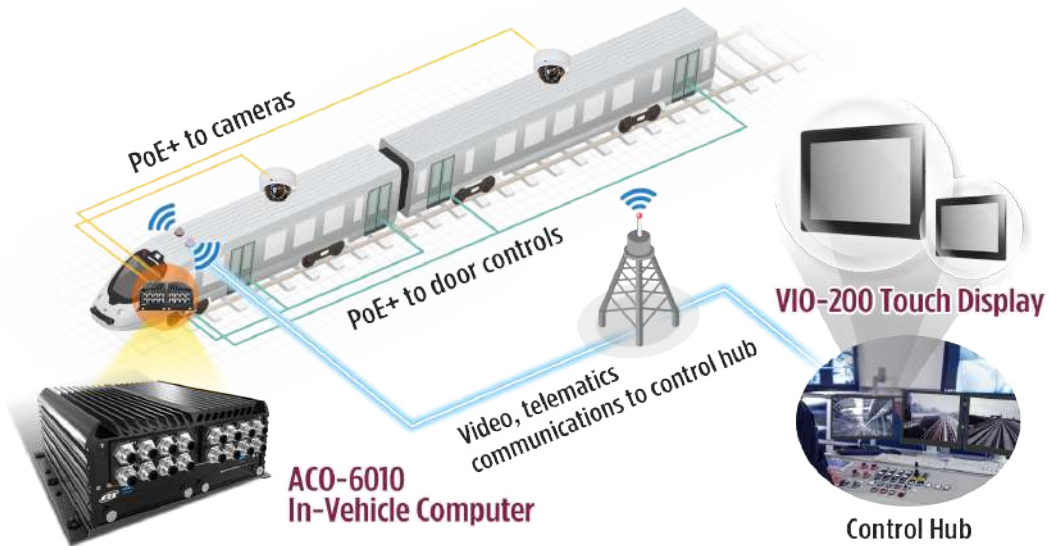
Maintaining momentum and performance with effective compliance testing

To deliver mission-critical performance within the harsh railway computing environment, train-borne systems must be validated to the EN-50155/50121-3-2/EN50121-4 series of standards for rolling stock computing. Complex criteria for durability and fault-free performance include factors such as shock and vibration, electromagnetic interference, power supply and surge protection, electrostatic discharge, temperature and humidity extremes, and much more. Compliance requires reliable performance validated for 24/7 operation for ~250,000 hours, or the equivalent of 30 years – a uniquely high bar that reflects technology's role in assuring passenger safety. The compliance review process itself was another hurdle that could drain OEM resources and challenge the skillset of the railway leader's internal team.

In-House Test Lab to Prequalify Embedded Computers for Strict Railway Equipment Certifications

Temperature & Humidity Chamber	1500 KGF Vibration Tester	Signal Integrity Tester

Thermal Shock Ramp Chamber	IR Thermal Sensor	Electrical Tester

CHECKLIST FOR EN50155 COMPLIANCE

- **Visual inspection**
- **Performance test**
- **Low temperature operation test**
  (minimum operating temperature for 2 hours)
- **Dry heat test**
  (maximum operating temperature for 6 hours)
- **Confirmation of operation over the full input voltage range**
- **Surge, ESD and transient tests**
- **Electrical insulation test**
- **Vibration, shock and bump test**
- **EMC Test**

WHY IS THE EN-50155 CERTIFICATION IMPORTANT FOR RAILWAY EQUIPMENT?

EN-50155 is an international railway certification for electronic equipment installed in railway and rolling stock trains. The certification requires compliance for wide temperatures, shock/vibration resistance, wide range power inputs, and electromagnetic compatibility(EMC)

THE SOLUTION

The railway leader turned to Premio, drawn initially to its rich portfolio of industrial fanless embedded computers and longtime focus on demanding in-vehicle deployments. Premio's deep bench of electrical and mechanical engineering talent was a competitive bonus contributing extensive real-world expertise to ease the difficulty of developing rugged, high reliability systems.

Designing standard, vetted, and certified solutions as a key feature of its product strategy, Premio offered the railway leader a building block approach with products that are near ready to deploy, pending final specifications from the OEM Customization was handled quickly as a final step to implementation, resulting in a testable product within an unheard of 30 days. The system plugged directly into the rolling stock's block architecture network and the firm was on the market with validated product faster and more cost effectively than demonstrated by any of its previous solutions.

Reducing development resources with pre-certified, modular systems Premio's ACO-6000 series of in-vehicle computers formed the backbone of this solution, an industrial grade compute system already reliability-tested and compliant to EN-50155/50121-3-2/EN50121-4 standards. The railway leader also expected compliance with IS402, a regulation on a common safety method for rail markets established by the European Union Agency for Railways. Premio took on the risk evaluation and assessment required by IS402, bringing its engineering team onsite for a deep dive into the testing processes to validate performance to this standard. As a modular design, the system's add-in 4LAN port was tuned, isolating the ports as required and allowing the system to be certified through HIPOT testing, including surge assessment, dielectric withstand, and insulation and pulse resistance.

With support for 6th and 7th Gen Intel® Core™ processors, the ACO-6000 series accesses inherently excellent CPU performance and power efficiency, along with a slate of on-chip features designed to boost connected, edge-to-cloud computing. This compact, rugged and fanless design is purpose-built for railway computing with up to 18 LAN ports and 16 PoE. Data handling is exceptional, with workloads decentralized away from the cloud for immediate processing. By balancing workloads near the source of data, the system more effectively analyzes data and acts in real time – aligning with the mission-critical nature of railway signaling operations.

IoT Connectivity Ready

Wifi 5 (802.11ac), Bluetooth 4.1, Cellular 4G LTE dual band 2.4 GHz and 5Ghz are supported in ACO series in-vehicle systems. These embedded edge computers can take advantage of the cloud to achieve greater productivity and savings. Connecting the unconnected creates a network of computing devices to optimize the functionality of the machines.

ACO-3000 Supports 2x SIM Card
(2x External)

ACO-6000 Supports 3x SIM Card
(2x External & 1x Internal)

## Extending the value of workload consolidation to IoT surveillance

Workload consolidation offered by Premio's ACO-6000 system also proved attractive for NVR data transmission in IoT surveillance applications. Premio's rugged NVRs uniquely meet the EN50155 standard's performance requirements for temperature, humidity, shock, and vibration, as well as the EN50121-3-2 mandate for electromagnetic compatibility. Blending these rugged features with solid state storage, RAID-based data redundancy, and inference processing distinguishes the system as a true rugged edge device – tailormade for visual processing and recording in environments with high vibration and movement, environmental contaminants, questionable power voltages and severe temperature conditions.

The system's scalable support of up to 16 PoE devices is a critical differentiator that enables placement of low-power cameras and peripherals in strategic positions, especially desirable where power resources are limited or unavailable. This unique feature has significant impact on the rolling stock environment: multiple cabins with as many as 16 cameras in each cabin can be used to create a highly effective, real-time surveillance network. To ensure passenger privacy and control sensitive information, the system capitalizes on the features of a trusted platform module (TPM), used to secure the hardware level, block malware, and encrypt video and other data in compliance with privacy controls such as the General Data Protection Regulation (GDPR).

Ensuring systemwide reliability with smart connectivity and reduced points of failure

Premio's solution offers even higher value by ensuring continuous wireless mobile connectivity via WiFi and 4G/LTE connections, with SIM module sockets for seamless connectivity from tower to entire fleet network. The system plays an important role in fleet management through integration with vehicle CAN bus processes. Critical data such as vehicle telematics, GPS, and speed are transmitted consistently, while scheduling information and safety data such as rail conditions or track obstructions are simultaneously received.

Features such as ignition management ensure the system safely boots down at engine shutdown, part of a smart, low maintenance design that protects vehicle downtime. A fanless and cable-free design further extends MTBF by eliminating potential points of failure, and effective M12 locking connections ensure solid connections for all PoE ports.
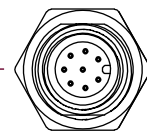
M12 CONNECTORS
Rugged Industrial Computing
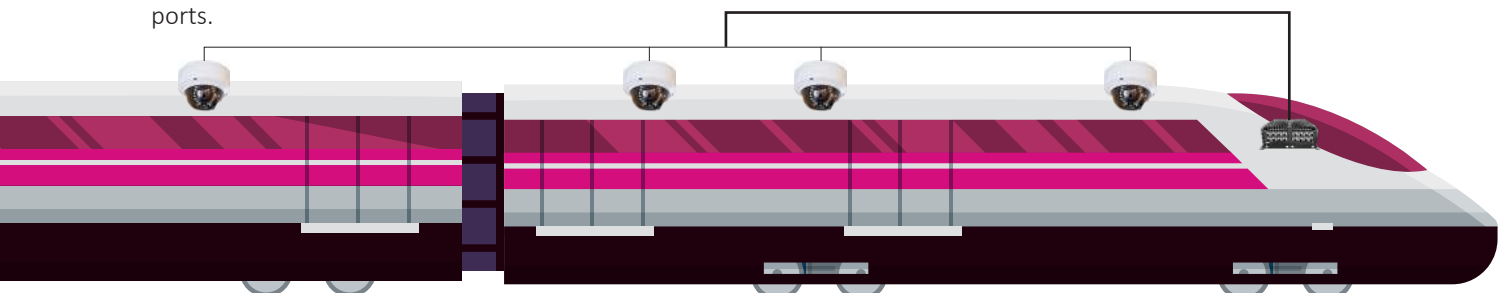
THE BENEFIT

Since June 2019, this railway leader has deployed more than 300 ACO-6000-based systems in its critical railway computing environments. Railway signaling and rugged NVRs are conducting extreme data processing at the edge – moving away from a centralized cloud platform to spare bandwidth, reduce latency and data bottlenecks, and pioneer a new focus on immediate insights by efficiently using data close to the source.

This global railway organization partnered with Premio for technical expertise and agility in defining a rugged edge system – and had a remarkably improved experience over its previous relationship with a tier-one embedded computing provider. The railway leader was able to retain its focus on its application without becoming mired in hardware requirements for secure, rugged performance. Premio's engineering skill and deep knowledge of in-vehicle computing shrank development timelines dramatically, delivering a standards-validated, high performance product for testing within 30 days. Development timeline was contained to nine months, reducing overall costs and resulting in a lower solution cost per unit. The railway leader was also able to capitalize on manufacturing agility and scalability, connecting with Premio's global manufacturing facilities that enabled them to quickly move the product worldwide.

Distinguishing performance and market leadership

Rapid arrival on the market was made more powerful with the system itself – a robust multi-core computing system with performance and features built for longevity. As railway applications become even more advanced, these rugged edge devices will unlock new opportunities in service and safety based on real-time decision making. For example, systems will handle advanced analysis at the edge, embracing machine learning to improve surveillance with facial recognition, object detection, and more. By capitalizing on compute power at the edge – fortified with Premio-led compliance, deep market expertise and smart IoT design – this railway leader is poised for long-term competitive value and market leadership.
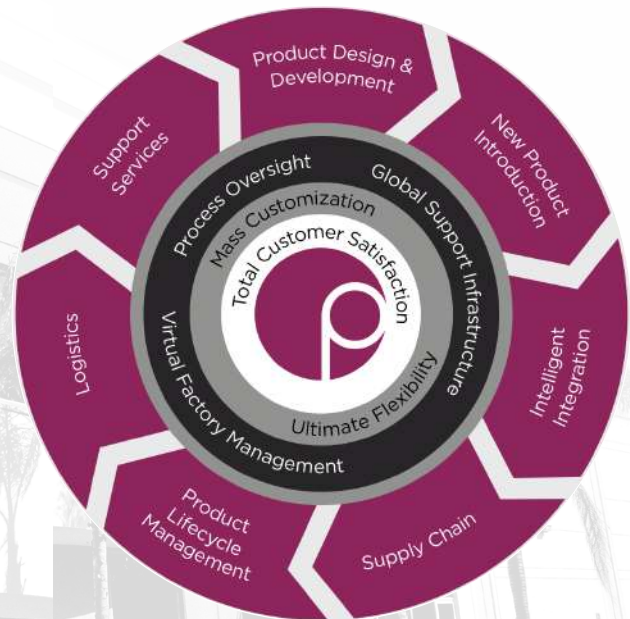
We Design, Manufacture, and Service customers around the world

CALIFORNIA(HQ)

ILLINOIS

GERMANY

TAIWAN

MALAYSIA

High-performance in-vehicle computer

ACO-6000
Surveillance Applied Fanless System with LGA-1151 socket for Intel® Kabylake & Skylake-S processors

ACO-6010
With 16 GbE in RJ-45 or M12 connectors with PoE option

ACO-6011x
With one PCI or PCIe x16 expansion slot

- Compact in-vehicle fanless computer with high performance
- Support Intel® 6th/7th generation Sky Lake and Kaby Lake processors
- Built-in ignition on delay control and battery voltage monitoring
- Support up to 18x LAN, 16x PoE
- E-Mark, EMC Conformity with EN50155 & EN50121-3-2

For more details please scan our QR code.
ACO-6000 series

Compact in-vehicle computer

ACO-3000
Vehicle Applied Fanless System based on Intel® Broadwell-U processors

ACO-3011x
With one PCI or PCIe x4 expansion slot

ACO-3022xx
With two PCI or PCIe x4 expansion slot

- Ultra compact in-vehicle fanless computer ideal for space-constrained applications
- Support Intel® 5th generation Broadwell-U mobile processors
- Built-in ignition on delay control and battery voltage monitoring
- Support up to 6x LAN, 4x PoE
- E-Mark, EMC Conformity with EN50155 & EN50121-3-2

For more details please scan our QR code.
ACO-3000 series