



ADLINK is dedicated to helping the railway industry accelerate digital transformation and AI-enabled implementation to drive safer, smarter and more reliable railway operations



ADLINK Railway Solutions Forward Into The Future



No method of modern transportation beats the train's longevity. Indeed, trains and railways remain a vital component of infrastructures around the world. From freight delivery across sprawling American countrysides to the advanced rail transportation networks of Asian and European metropolises, hundreds of millions of people rely on rail transit each day. Railways also remain a reliable, cost-effective method of shipping freight.

Innovation continues to improve both trains and terminals. Although consumers and the media typically focus on automotive advances, modern trains similarly benefit from numerous enhancements. For instance, major railroad companies regularly rely on wind tunnel testing and advanced fuel management systems to maximize performance, fuel efficiency, and emissions control. Similarly, they require computing capabilities and artificial intelligence (AI) applications able to streamline operations and deliver new business insights.

As a trusted manufacturer of powerful and reliable computer systems with over 25 years of experience, ADLINK specializes in serving markets with unique challenges. Thanks to its in-house design and manufacturing, ADLINK provides an impressive portfolio of cost-effective commercial off-the-shelf (COTS) railway solutions able to withstand punishing environmental conditions and non-stop use without compromising quality, as well as being field-proven and reliable for both brownfield and greenfield onboard and wayside applications. The company excels at delivering technology upgrades and insertions, supply longevity, COTS and ODM (customization) capabilities, and maximum business flexibility for train control, rail signaling, automation, and digitization.



Video: Forward into the Future – ADLINK Railway Solutions

Embracing Current Standards & New Technologies

To survive the rigorous shocks, vibration, humidity, and temperatures of railway transportation, electronics and computing devices require engineering and rugged construction that goes beyond that which consumer equivalents can tolerate. Rail transit service providers, freight shipping companies, and other related businesses might deploy conventional, non-rugged computing solutions, but device failure can have disastrous consequences.

ADLINK engineering and development teams are dedicated to ensuring that our railway products adhere to the EN 50155 “Railways Applications Electronic Equipment Used on Rolling Stock” standard. These stringent requirements stipulate thresholds and ranges for environmental conditions. ADLINK modules, panel computers, and other EN 50155-certified computing platforms are ready for deployment in railcars, passenger terminals, and many other transportation settings.

Several of ADLINK’s railway products go even further by meeting or exceeding military standard specifications for extreme heat or cold, high dust, and high moisture conditions. With leading technical expertise in designing military-standard compliant embedded computing boards and systems for mission-critical applications, ADLINK delivers solutions that provide exceptional performance wherever rails lead.

The company’s strong position and extensive CompactPCI experience give it unmatched expertise in developing CompactPCI solutions for a wide range of demanding industries. As these sectors increasingly turn to AI, the Internet of Things (IoT), and edge computing, ADLINK provides these markets with powerful offerings that sustain legacy technologies while spearheading new innovations.

ADLINK’s Rugged by Design hardware survives where other manufacturers fall short, but the company focuses on more than resilience. As a member of the Intel® IoT Solutions Titanium Partner and NVIDIA Elite Partner programs, ADLINK obtains access to the latest CPU and GPU technologies as well as the highest levels of technical support from Intel and NVIDIA. As a result, ADLINK small form factor railway solutions provide the performance and power savings that make them smarter, safer, and more reliable for AI, IoT, or edge railway computing applications.



Video: On Track to the Future – Intel & ADLINK Facilitate Railway Digitalization

Accelerating Railway Digitalization with AI

Railway transportation has long been thought of as conservative or “old school,” but current trends are rapidly pushing the rail industry to digitalize and embrace cutting-edge technologies. From an environmental standpoint, rail emits over [6x less CO₂](#) per passenger than air travel, making rail clearly preferable for those wanting to combat climate change. Meanwhile, the world’s growing population continues to [urbanize](#), putting more pressure on railways to help move more people more efficiently, and over-congested [global supply chains](#) need every possible bit of added transportation productivity to help alleviate ongoing shortages.

Railway efficiency is not bounded by gauge or speed. Rather, AI deployed on railway computing infrastructure, especially at the network edge, has tremendous potential to improve operations and bottom lines. When implemented in trucks, a 2020 [study](#) found that driverless vehicles realized 29% to 45% cost savings compared to those driven manually, and total cost of vehicle ownership dropped by over 15%. Analogous improvements can be found in rail transportation. AI effectively eliminates the delays and errors caused by humans in everyday operation, and automated driving negates the need for engineers to operate trains.

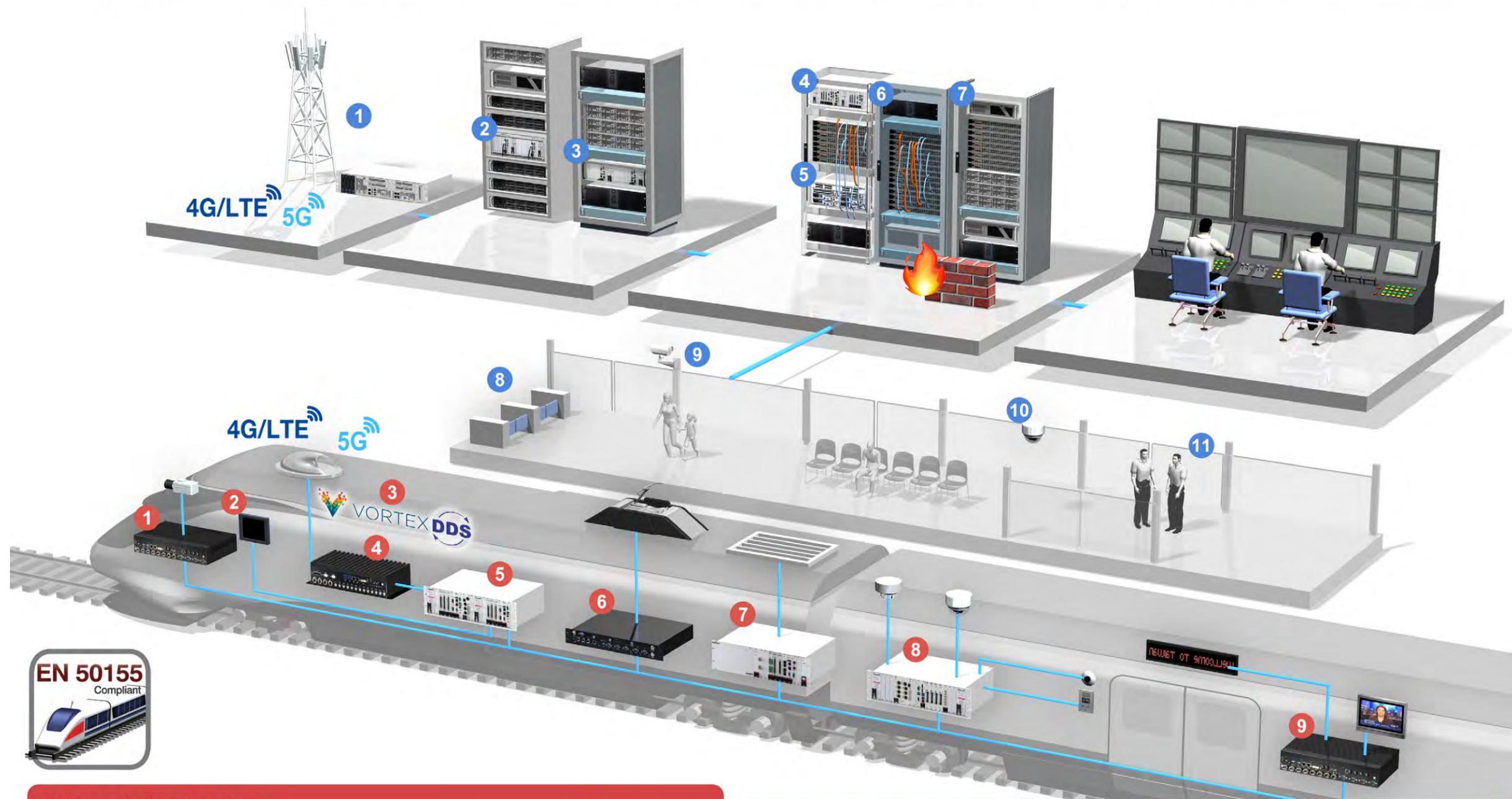
AI opens possibilities for a host of other railway applications and improvements, including:

- Biometric ticketing, which uses AI to streamline the handling of passenger fares by using body scans (e.g., face, fingerprint, or retina) linked to passenger payment accounts.
- Crowd monitoring, to help assess terminal congestion and ensure patrons don’t evade paying fares.

- Delay-time prediction, which involves AI assessing current train statuses against a wealth of historical data to make informed estimates on train delay developments and remediation times.
- Fuel management, to generate fewer emissions while idling by putting the engine into a low-power state.
- Infrastructure monitoring, wherein AI analyzes real-time camera feeds from locations ranging from train axles to wayside stations to watch for obstructions, damage, or other anomalies.
- Standalone switching, in which AI systems and machine-to-machine (M2M) communications optimize train schedules and paths.
- System-wide analytics based on metrics such as network velocity, aggregate customer satisfaction, labor utilization, and productivity, all of which help inform ROI measurements and long-term planning.

ADLINK now offers a range of solutions for onboard and wayside applications, all of which are based on open standards-based computing hardware. Each solution is optimized for different workloads and environments. Most are designed with specific advantages for AI-enhanced applications, such as hardware-based algorithm acceleration built into the CPU or extensibility to add greater AI acceleration with GPU and/or FPGA resources. In all cases, ADLINK engineers these solutions to deliver an optimal blend of performance, low-power operation, and ruggedness, allowing them to survive many years in harsh railway environments. ADLINK prepares railway clients to seize AI’s benefits today and make sure those benefits deliver increasing value into the future.

Leading COTS/ODM Solutions for Train Control, Rail Signaling, Automation and Digitalization



Onboard Applications

- | | |
|---|--|
| 1 AI-enabled Video Analytics for Railroad Hazard/Intrusion Detection | 6 Locomotive Data Recorder |
| 2 Driver Machine Interface (DMI) | 7 Train Control & Monitoring System (TCMS) |
| 3 Data Distribution Service (DDS) | 8 Rugged Storage Systems for Video Surveillance |
| 4 Train-to-Ground Communications Control Unit (CCU) | 9 Passenger Information System (PIS) |
| 5 Automatic Train Operation (ATO) | |

Wayside Applications

- | | |
|--|--|
| 1 Multi-access Edge Computing (MEC) | 7 Video Processing Server |
| 2 Radio Block Center (RBC) | 8 Automated Fare Collection (AFC) |
| 3 Computer-based Interlocking (CBI) | 9 Facial Recognition |
| 4 Centralized Traffic Control (CTC) | 10 Platform Video Surveillance |
| 5 Network Security Server | 11 Platform Screen Doors (PSD) |
| 6 Automatic Train Supervisor (ATS) | |

ADLINK Railway Solutions

As a new decade begins, public and private rail transit providers can invest in a variety of computing equipment for deployment in railcars, terminals, and other areas critical to railway operations. ADLINK has decades of experience developing hardware that's Rugged by Design and thus ideally configured for the frequently punishing operating conditions railway environments can present. The resulting product stack features best-in-class components backed by ADLINK's industry-leading customer service. ADLINK also regularly works with its customers to build customized solutions tailored to their exact needs. With a deep understanding of how important supply longevity is to the rail industry, ADLINK ensures best practices in product obsolescence and lifecycle management by fully leveraging its long-standing strategic partnerships with major hardware component and software vendors.

AI-enabled Video Analytics Platform: AVA Series

The ADLINK AVA Series represents a comprehensive and versatile set of EN 50155-compliant solutions that bring AI and the IoT to the railway industry. Designed for the AIoT (AI and IoT), this AI-enabled video analytics platform is one of the company's most versatile offerings.



Harness AI technologies and deploy smart, rugged, real-time graphics/video applications vital to today's increasingly complex railway operations

ADLINK's Embedded MXM GPU modules, based on NVIDIA® Quadro® GPUs, give AVA systems real-time video/graphics analytics capabilities suitable for a range of applications. Depending on their needs, rail systems integrators can deploy rugged AVA systems in applications such as railroad hazard detection, rail inspection, surveillance and intrusion detection, and passenger information systems. The Quadro GPU's massively parallel computing architecture makes it an ideal

choice for deep learning algorithms that can automatically detect equipment faults. When installed in a specialized inspection railcar, AVA-5500 and -5600 models can process images of vital wayside equipment while travelling at speeds up to 120 km/h. The AVA system then alerts maintenance crews to perform preemptive repairs as identified. Elsewhere, train terminal security personnel have used AVAs for real-time video analysis of camera footage, where algorithms can spot suspicious activity. Other AI-driven applications include highly accurate arrival/departure predictions, real-time diagnostics, and emergency response.

The AVA-5500 comes in a compact 360mm x 225mm footprint and features a choice of Intel® Core™ i7-7820EQ (3.0 GHz) or Intel® Core™ i7-6830EQ (2.8 GHz) processors, both quad-core with Intel® Hyper-Threading. With two SODIMM sockets, the AVA-5520 supports up to 32 GB of DDR4-2133 dual-channel memory. Combined with the NVIDIA® Quadro® GPU, the AVA-5500 offers six DisplayPort connections (two via integrated Intel graphics, four with lockable connectors via NVIDIA GPU MXM module) as well as a DVI-I display output for legacy screens. Additionally, the AVA-5500 provides numerous SATA, M.2, Mini PCIe, and CFast options for expansion, customization, and scalability. The AVA-5500 also provides four USB 3.0 Type A ports and four DB-9 RS-232/422/485 serial ports with 2KVrms isolation.

The AVA-5600 varies from the AVA-5500 in that it uses a 2U, 19" form factor for easy rack mounting and integrates upgradeability to NVIDIA Quadro RTX 5000 MXM graphics. Moreover, the system's front panel features two 40W 12V power outputs, a 300W 3-pin power inlet, and reserved I/O for running Train Real-time Data Protocol (TRDP) over CAN bus.

The AVA-RAGX specifically targets space-restricted environments with its 288 x 190 x 72 mm dimensions, making it ideal for edge-type applications with small solution enclosures. The AVA-RAGX provides a full complement of I/O ports for railway application needs, including four M12 Gigabit Ethernet ports and wireless connectivity as well as four digital inputs and four digital outputs (24VDC-110VDC, 1.5kV isolation). This expandability stands atop an NVIDIA-based foundation of the Jetson AGX Xavier industrial module containing an 8-core NVIDIA Carmel CPU and 512-core NVIDIA Volta GPU. The industrial version of the Jetson platform emphasizes low power consumption with high performance specifically for compact, edge applications under harsh operating conditions.

Across all models, ADLINK's AVA Series targets high compute density with I/O flexibility suited to demanding railway deployments. These are the systems railways need to realize AI's advantages throughout their edge infrastructure.



For data transmission, ADLINK's AVA-5500 gives systems integrators numerous options to suit their existing infrastructure. The system's 10 Ethernet ports are comprised of two RJ-45 1000BASE-T, four M12 X-code 1000BASE-T with PoE Class 2 (7W) and 1.5kV isolation, and four M12 A-code 1000BASE-T with 1.5kV isolation. Using the built-in Mini PCIe slots, wireless connectivity can be added to the AVA-5500 with a cellular modem (3G/4G) or WLAN module, and there are four cutouts reserved for RP-SMA antennae. With this feature set, the AVA-5500 is also well equipped for applications in other industries, including defense, energy, and industrial automation.

Driver Machine Interface: DMI-1040 & DMI-1210

The DMI-1040 is one of two human machine interface (HMI) panel computers from ADLINK that give human operators the tools they need to do their jobs. Inside, an Intel Atom® x5-E3930 processor runs at up to 1.8 GHz (1.3 GHz base frequency) and is matched with 2GB of DDR3L low-voltage memory (up to 8GB optional). The DMI-1040 has 64GB of eMMC storage as well as one CFAST slot for expansion. Users have access to additional expansion via one full-size Mini PCIe slot and two SIM card slots. This system also has three M12 A-coded 10/100/1000BASE-T Ethernet ports supporting 2kVrms isolation.

A large, 10.4" (4:3) TFT display provides 1,000 cd/m² luminance, a contrast ratio of 1000:1, and a 1024 x 768 resolution. It also features a 5-wire resistive touchscreen and auto dimming. ADLINK encases these components in a highly resilient chassis. An operating temperature range of -25°C to +70°C makes the DMI-1040 EN 50155 class OT3-compliant, and its numerous input voltages (24VDC, 36VDC, 72VDC, 110VDC) are also EN 50155-compliant. The DMI-1040 has IP65 front and IP20 rear ingress ratings.

For rail signaling and train control, ADLINK's new DMI-1210 offers many advantages. This powerful, rugged panel computer is EN 50155-compliant and also utilizes the Intel Atom® x5-E3930 processor. The DMI-1210 comes standard with 4GB of DDR3L-1600MHz and can accommodate an additional 4GB. The panel computer also offers exceptional I/O flexibility. There are two M12 GbE ports, two DB-9 RS-232/422/485 serial ports, and one M8 USB 1.1 port. The DMI-1210 has an integrated 72-channel high-sensitivity GNSS receiver, and users can supplement the system with MVB and CAN bus support via add-on modules. For additional expansion options, the DMI-1210 includes two full-size Mini PCIe slots, two micro-SIM slots, an onboard USB 2.0 wafer connector, one PC/104 slot, and both an M.2 slot and CFAST slot to expand the system's storage.

ADLINK matches the DMI-1210's high-performance internal components with a 12.1" (4:3) TFT LCD 5-wire resistive touchscreen with 1024 x 768 resolution, a contrast ratio of 700:1, and a 600 cd/m² luminance rating. On the front bezel, a light sensor detects ambient lighting conditions and ties into an auto-dimming application. The DMI-1210's range of nominal input voltage—24VDC, 36VDC, 72VDC, and 110VDC—ensures EN 50155 compliance.



Reliably deliver critical train information for drivers to monitor operations, conduct diagnostics, manage broadcasting, and control subsystems in real time, no matter how challenging the operating environment

Data Collection Systems: DCS-211 & DCS-RAPL

Edge networks equipped with a range of IoT devices can experience ongoing, potentially heavy data loads. When data collection flows smoothly, the railway operates efficiently. If data collection fails, the results can be significant delays or potentially hazardous outcomes. The ADLINK DCS family brings high-performance capability to process large volumes of data in real time with the reliability railways need to maintain peak operations.

The 19" DCS-211 data collection system is compatible with a 1U or 1.5U form factor for fast deployment in existing racks. It features eight isolated digital input (DI) channels with 2.5KVrms optical isolation and input voltage up to 137.5V (nominal voltages of 24V/36V/72V/110V). There are six digital output (DO) channels: four DO channels without isolation in a D-sub connector and two isolated DO channels with independently controlled internal integrated relays in a separate D-sub connector.



Collect and store critical data securely to facilitate train operation monitoring, driver performance evaluation, and post-event investigation; reliable data management can yield improved operational efficiency and safety

The DCS-211 uses an Intel Atom® x5-E3930 processor paired with 4GB DDR3L-1600MHz memory (upgradable to 8GB). It also has four GbE ports (1x RJ-45, 3x M12 with 2KVrms isolation), two programmable RS-232/422/485 serial ports via front panel DB-9 connectors, two USB Type A connectors (1x 3.0, 1x 2.0), 32GB of built-in eMMC 5.0 storage (64GB optional), one M.2 2280 slot for "M key" SATA SSDs, and space on the front panel for a hot swappable 2.5" SSD or CFast slot.

Rail systems integrators can take advantage of the DCS-211's three Mini PCIe slots (2x PCIe + USB 2.0, 1x USB 3.0), which support full or half size modules with one USIM slot each. One of the USIM slots is onboard, and two are externally accessible from the front panel and protected by a cover. Using the Mini PCIe slots, the DCS-211 can be configured for 3G, 4G, GPS, CAN, MVB as well as GNSS. There are four reserved antenna connector cutouts supporting three RP-SMA connectors for cellular and Wi-Fi, and an optional SMA connector for GNSS.

For even more compact deployments with lower I/O connectivity needs, ADLINK provides the DCS-RAPL. Based on the same compute and memory foundation as the DCS-211, the DCS-RAPL downsizes to a 230.4 x 190.7 x 44.20 mm form factor designed for wall mounting and consumes a maximum of 50W. The system offers three M12 Gigabit Ethernet ports, an M8 connector USB 2.0 port, one USB 3.0 port with a dust cover, and a range of external serial and internal eMMC and CFast ports.

High Performance Extreme Rugged Computer: HPERC-KBL-MC

The new HPERC-KBL-MC is built to withstand some of the harshest conditions on the planet. This Extreme Rugged small form factor computer features an Intel® Xeon® E3-1505M v6 3.0GHz quad-core processor and Intel® CM238 chipset. Customers can supplement this with an NVIDIA® Quadro® series MXM graphics module for AI, deep learning, IoT, and other applications that require massively parallel computing resources. For added durability, the HPERC-KBL-MC features 16GB of soldered onboard DDR4-2400MHz ECC SDRAM (optionally 32GB).

The HPERC-KBL-MC's standard available I/O exemplifies its versatility. With three video outputs (2x DVI, 1x VGA), the system can drive three displays simultaneously. Four 10/100/1000 Mbps Ethernet ports are available via Intel® Ethernet Controllers I210, as well as six USB 2.0 and seven RS-232/422 serial ports. Up to two 2.5" 6 Gb/s SATA SSDs can be installed, and the HPERC-KBL-MC also supports RAID 0/1. A single SDHC slot recognizes cards up to 64GB. PCI/104 Express and PCI Express Mini Card slots (both PCIe Gen2) further extend the system's expandability.

Although ADLINK built the HPERC-KBL-MC to meet demanding MIL standards utilizing elements such as environmental sealing and MIL-DTL-38999 connectors, this system also has the resilience necessary to survive the rigors of railway transportation in virtually any environmental setting. The system meets various certifications and standards for immersion, salt spray, altitude, humidity, shock and vibration, EMI/EMC, power, and operating temperature. The HPERC-KBL-MC is also built to meet the VITA 75 cold plate mounting specification for exceptional durability.



Outperform the competition with an ultra-compact and Extreme Rugged design for high-performance computing and GPGPU capabilities in the most demanding environments

Ultra-compact IoT Platform: MXE-210 Series

Identifying the need for compact, IoT appliances that can serve several industries, ADLINK designed the MXE-210 Series ultra-compact embedded platform. Depending on SKU, the MXE-210 Series offers either an Intel Atom® x7-3950 1.6 GHz (2.0 GHz burst) or Intel Atom® x5-3930 1.3 GHz (1.8 GHz burst) processor. All systems feature 2 GB of RAM that can be upgraded up to 8GB.

The MXE-210 Series' I/O and slot selection meet a wide range of expansion needs, including a DisplayPort, two USB 2.0 and two USB 3.0 ports, two Gigabit Ethernet ports, and two COM ports (RS-232/422/485). Internally, a pair of Mini PCIe slots, one USIM slot, one mSATA, and a Micro SD slot make the MXE-210 Series highly configurable and, via USIM, let integrators supplement their systems with Wi-Fi, Bluetooth, 3G, LoRa (SX1276), and 4G LTE. Optionally, the MXE-210 Series can accommodate a 2.5" SATA SSD storage kit or isolated 8x DI/8x DO.

Featuring the ultra-rugged construction of ADLINK's Matrix line, ADLINK's MXE-210 Series not only meets the EN50121 railway standard but also protects the system against extreme conditions. It has a shock tolerance of 100 G and boasts an extended operating temperature range of -40°C to 85°C. Out of the box, MXE-210 Series systems offer DIN rail mounting support, and customers can add optional wall mount support. ADLINK also includes its SEMA solution for embedded management.



Drive smart, safe train monitoring and control by centralizing the management of ever-increasing numbers of sensors and devices; management becomes efficient and scalable through high system configurability and deployment flexibility

Hybrid Architecture CompactPCI System: TRC-3000

Performance-centric CompactPCI solutions often struggle to accommodate high-power CPU, GPU, and switch components within a compact, passively cooled enclosure. The TRC-3000 is a 2U/3U 19" rackmount fanless system that supports a range of plug-in I/O modules. Specifically, most of the chassis interior belongs to two high-power board/peripheral slots, with two more vertical slots for low-power peripherals and two additional 6HP slots. The TRC-3000 provides superior thermal performance for demanding CPU/GPU heterogeneous computing applications that complement railway needs while maintaining the ruggedness demanded in such environments.



Innovative hybrid architecture protects customers' investments in existing infrastructure while boosting system performance via a seamless technology upgrade and insertion

Rugged 3U CompactPCI Process Blade: cPCI-3630 Series

Recognizing the increasing need for powerful yet extremely tough systems configured for rapid deployment, ADLINK continues to expand its range of CompactPCI processor blades. The cPCI-3630 Series flagship is a 3U, Rugged by Design, Intel Atom®-based blade built to operate in the challenging environmental conditions many railway operators face. All SKUs are EN 50155-compliant. Customers have the option of a quad-core Intel Atom® x7-5950 (1.6 GHz) or a dual-core Intel Atom® x5-3930 (1.3 GHz). The cPCI-3630 Series can support up to 8 GB of soldered onboard dual-channel DDR3L 1600 MHz memory.

The cPCI-3630 Series processor blades offer a wide range of connectivity, graphics, and storage options, giving systems integrators the opportunity to select a blade according to specific application needs. For example, most SKUs include two 10/100/1000BASE-T ports and a VGA connector, but models with two additional M12 MIL-STD GbE connectors or two DisplayPort connectors that support up to 4096x2160p are also available. Some dual-slot SKUs feature a serial port for additional customization. Multiple storage options exist, as well.

As Rugged by Design units, cPCI-3630 Series CompactPCI blades meet numerous mechanical and environmental standards. They are EN 50155 Tx-compliant for operating temperature, functioning in a temperature range of -40°C to 70°C (fanless) or -40°C to 85°C (forced air cooling). ADLINK cPCI-3630 Series systems also meet EN 50155 requirements for shock and vibration, plus MIL-STD-810G for altitude.



Enable a wide variety of railway applications with an extensive, cost-effective portfolio featuring optimum performance, reliability, flexibility, sustainability, and supply longevity

Use Case: Powerful AI-enabled Railway Obstacle Detection

Although the world's rail systems safely transport millions of passengers to their destinations every day, real risks remain, and the consequences can be serious. Derailment accidents, terrorist attacks, and other dangers are unfortunate occurrences that railways systems and operators must anticipate and prepare to mitigate. Modern security requires an advanced, multi-pronged approach, where AI, machine learning, edge analytics, IoT, predictive and reactive analytics, and wireless communications seamlessly come together to give professionals a comprehensive understanding of potential vulnerabilities.

ADLINK is at the forefront of bringing robust, military-grade hardware to rail systems integrators around the world. With extensive experience in developing Extreme Rugged computing platforms for defense, industrial, and other verticals, ADLINK provides essential components that meet performance requirements for real-time, multi-stream video analytics that are able to operate in environments where shock and vibration, electromagnetic interference, extreme temperatures, and other conditions are common.

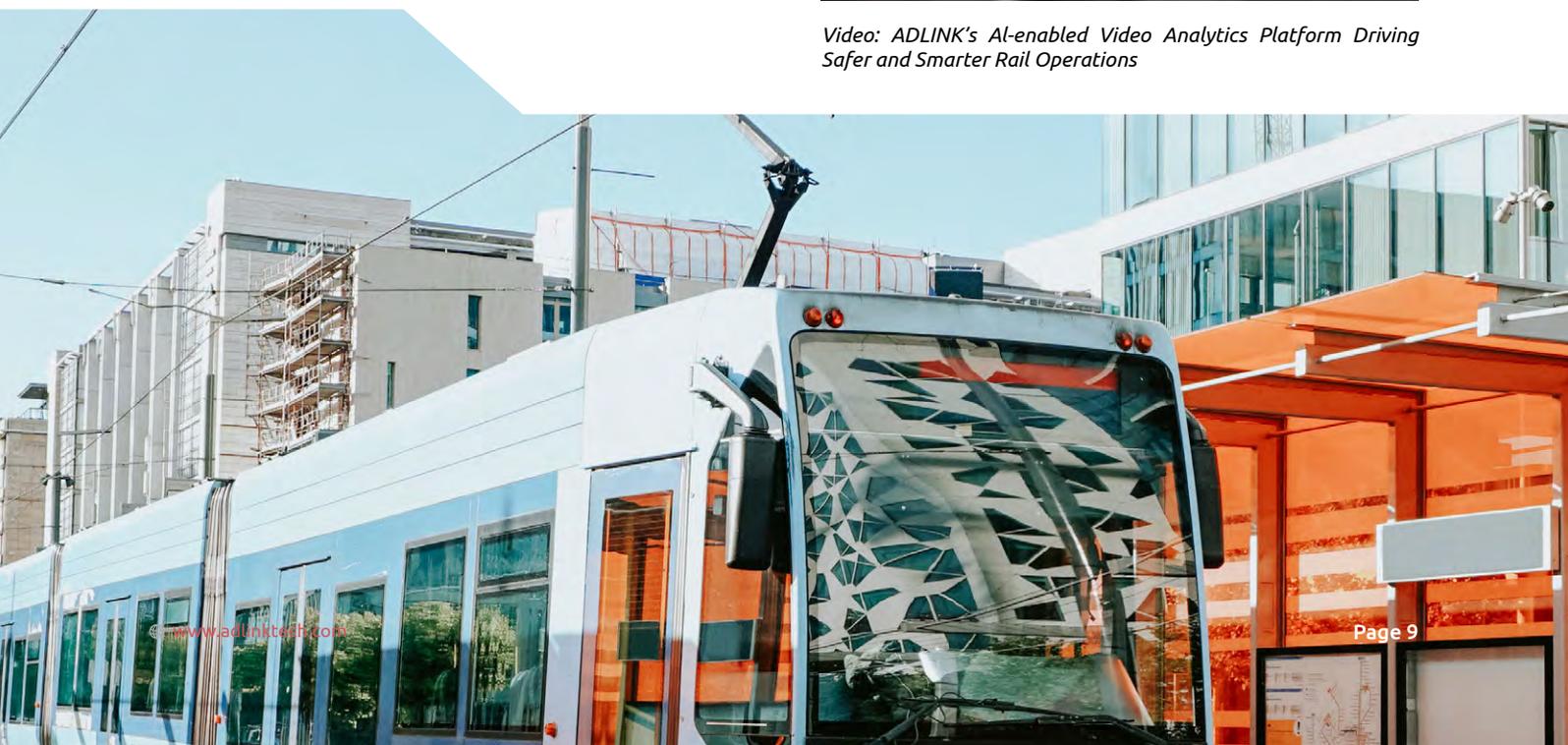
Recently, ADLINK's expertise proved to be an ideal match for a European railway customer that had developed a railway obstacle recognition system. The customer's requirements were substantial. Their system relied on a combination of optical radar, digital cameras, and a host of sensors to identify railway failures or other obstacles by leveraging AI-based processing algorithms. The graphics processing load for this application was immense.

ADLINK's cutting-edge AVA-5500 AI-enabled Video Analytics (AVA) platform met the challenge. The system's powerful GPGPU-assisted AI processing and software support helped the railway customer optimize their applications according to their needs. Thanks to the AVA-5500's EN 50155-compliant Extreme Rugged construction, it was also ready for immediate deployment where the railway obstacle recognition system would operate.

The AVA-5500 platform's success in real-time rail obstacle detection makes it equally suitable for a similar role in a railway terminal or deployed in other specialized rail inspection cars. Featuring quad-core Intel processors (Core™ i7-6820EQ or Core™ i7-7820EQ) and an NVIDIA® Quadro® GPU, the AVA-5500 is equipped for modern, demanding video processing work of all kinds. It has a host of storage and connectivity options, all housed in a rugged, fanless chassis that protects its internal components from damaging environments. ADLINK works closely with its other customers in the transportation industry to configure and deliver AVA-5500 platforms to meet specific and unique needs.



Video: ADLINK's AI-enabled Video Analytics Platform Driving Safer and Smarter Rail Operations





Use Case: Seamless Transition to Next-Generation LDARS

Event recording continues to be a critical aspect to railways and other transportation systems. It also continues to present operators with different demands. For example, the 2014 disappearance of Malaysia Airlines MH370 prompted a world-renowned Locomotive Data Acquisition Recording System (LDARS) solution provider to reassess its approach to event recording.

Rather than rely on the traditional “black box” approach of recording and storing event data locally, and then retrieving it in a lab as part of an after-event investigation, the U.S.-based company sought to develop a live event recording system capable of streaming data to the cloud. From there, credentialed personnel can access and analyze data in real time for any railcar, locomotive, or train that has the LDARS system installed.

However, the company’s improved LDARS system clearly required more CPU resources than its legacy LDARS PC/104 computing platform could provide. They had developed their LDARS solution around a small form factor built for fanless operation, stackable modular flexibility, low power consumption, and rugged durability — all good attributes, but ones that had been implemented in a way that limited performance. Their next generation, real-time stream event recording system couldn’t expand beyond the form factor’s restrictions.

Moreover, the LDARS system constituted only a fraction of the train’s complete onboard Positive Train Control (PTC) system, and the next generation solution couldn’t expand beyond the legacy system’s total footprint. In short, the company needed higher performance while maintaining a fanless design (for dust resistance) without exceeding thermal and power thresholds.

ADLINK provided the initial solution for the new LDARS system and also supplied its eventual successor. At first, the company selected ADLINK’s CoreModule-920, which featured an 3rd Gen Intel® Core™ or Xeon® processor and fast I/O connections, but then the LDARS company migrated to ADLINK’s CM4-SL2 PCI/104-Express single board computer. Boasting a 6th Gen Intel® Core™ processor, ADLINK’s offering also uses latching-type connectors for enhanced security, convenience and time-to-market benefits. Without latching connectors, cable connections require hot glue to maintain ruggedness, which is far from ideal.

As part of the PC/104 Consortium, ADLINK remains at the forefront of the form factor and has an extensive portfolio of COTS products designed to PC/104 standards. Customers can easily select an existing product and drastically reduce their time to market. In the event customers have special considerations, ADLINK’s in-house engineers and designers are able to use an existing product and tailor it to new purposes or requirements.



Use Case: ProRail and ADLINK Vortex OpenSplice

ADLINK has established a reputation as a leading component manufacturer across multiple industries thanks to consistent excellence over the last decades. However, the company has also invested considerable resources in software development for these same industries. One such example is ADLINK's Vortex Data Distribution Service (DDS) data sharing software framework, which can serve many vertical markets, including transportation.

Dutch organization ProRail relies on ADLINK Vortex OpenSplice for important information management of its railway systems. Reliable and fault-tolerant, ADLINK Vortex OpenSplice data-sharing platform helps ProRail juggle the 6,000 trains carrying 1.2 million passengers every day, the Netherlands' railways being among the busiest in Europe. "Vortex OpenSplice provides the real-time functionality and mission-critical performance we need," said Henk Bothof, CIO at ProRail. "It also delivers that important capability to maintain non-volatile information for late-joiners in a fault-tolerant way."

The traffic control security systems ProRail relies on pass through the ASTRIS system, the overall management tool for mission-critical rail infrastructure. ADLINK's Vortex OpenSplice operates within this system, and it handles seamless data sharing across sensors, components, applications, and systems that ProRail has deployed across its railways.

ADLINK Vortex OpenSplice stands above other commercial offerings that use the open-source implementation of the Object Management Group's (OMG) DDS standard. ADLINK has developed Vortex OpenSplice to share and integrate data across a wide range of operating systems and platforms, as well as industries. ADLINK's software is compliant with OMG DDS v1.4 and OMG-DDSI/ RTPS v2.2 wire-protocol standards. The DDS implementation is intended for both server-class platforms and specialized embedded environments and is a crucial element of ADLINK's Vortex family of Industrial Internet of Things (IIoT)-enabling technologies.

Rugged Fanless Railway Platforms

AVA-5500



Rugged, Fanless AI-enabled Video Analytics Platform with NVIDIA® Quadro® GPU

- 6th/7th Gen Intel® Core™ i7 processors
- NVIDIA® Quadro® GPU MXM 3.1 Type A/B module on PCIe x16 Gen 3
- 8x M12 GbE (4x PoE), 4x RS-422, 4x USB 3.0, 1x DVI-I, 4x DisplayPort with lockable connectors; 4x isolated DI and 4x isolated DO
- Multiple storage options: 2x 2.5" SATA 6.0 Gb/s drive bays, 1x M.2 2280 slot, 1x CFast socket
- GNSS/3G/4G/WLAN support via 2x mPCIe slots and 2x USIM slots
- MVB/CAN bus support through mPCIe add-on modules
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -25°C to +70°C wide operating temperature range (EN 50155 class OT3)

AVA-5600 New



19" Rackmount Rugged, Fanless AIoT Platform for Real-time Video/Graphics Analytics

- Intel® Core™ i7-7820EQ Processor and Mobile Intel® CM236 Chipset
- NVIDIA Quadro® GPU MXM 3.1 Type A/B module on PCIe x16
- 4x M12 GbE with PoE, 4x USB 3.0
- Rich Storage Options: 2.5" SATA 6.0 Gb/s drive bay, 1x M.2 2280 slot, 1x CFast socket
- GNSS/3G/4G/WLAN support via 2x Mini PCIe slots and 2x USIM slots
- MVB/CAN bus support by Mini PCIe add-on module (BOM option)
- Nominal Voltage: 110VDC (EN 50155 compliant)

DCS-211 New



1.5U 19" Rackmount Data Collection System

- Intel Atom® E3930 processor
- 8x Digital I/O with 2kVrms isolation, 4x 2A relays in DO
- 3x M12 GbE, 1x RJ-45 GbE, 2x isolated RS232/422/485, 2x USB and one lockable HDMI port
- Two DB-9 connector cutouts reserved for MVB or CAN modules
- Up to 3x mPCIe slots with one USIM card slot each
- Storage: up to 64GB eMMC 5.0, 1x 2.5" SATA drive bay (CFast optional) and onboard M.2 slot
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -40°C to +70°C wide operating temperature range (EN 50155 TX)

CCU-5500



High-Performance Fanless Onboard Wi-Fi Communication Control Unit

- 6th/7th Gen Intel® Core™ i7 quad-core processors
- Up to six mPCIe slots for cellular modules and dual SIM slots for each module
- QMA antenna connectors supported
- 2x M12 GbE, 2x M8 USB 2.0, 8x Digital I/O and 2x serial ports
- Storage: 2.5" SATA drive bay, externally accessible CFast slot, and onboard M.2 slot
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -40°C to +70°C wide operating temperature range (EN 50155 TX)

DMI-1210 / DMI-1040



Driver HMI with Intel Atom® x5-E3930 Processor

- Intel Atom® x5-E3930 processor, up to 1.8GHz
- 12.1"/10.4" color display: 4:3, 1024x768 pixels, 5-wire resistive touch
- Up to 8GB DDR3L memory; up to 64GB eMMC storage
- MVB/CAN bus support by PC/104 or mPCIe add-on modules
- DMI-1210: built in GNSS and two mPCIe card slots for cellular modem with USIM
- DMI-1210: isolated 2x M12 GbE, 2x DB-9 serial and 1x M8 USB 1.1 ports
- DMI-1040: isolated 3x M12 GbE, 2x DB-9 serial and 1x M8 USB 2.0 ports
- IP65 front and IP20 rear ingress ratings
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -25°C to +70°C wide operating temperature range (EN 50155 class OT3)

AVA-RAGX New



Fanless AIoT Video Analytics Platform with NVIDIA Jetson AGX Xavier

- NVIDIA Jetson AGX Xavier with 32 TOPs AI performance
- 4x M12 GbE with PoE, 1x lockable HDMI output, 4x USB 3.0
- 1x M.2 B-key for LTE/5G; 1x M.2 A/E key 2230 for Wi-Fi
- 2x CAN DB-9 CAN-FD from AGX module, with isolation
- Power with ignition control
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -25°C to +70°C wide operating temperature range (EN 50155 class OT3)

DCS-RAPL New



Fanless Railway Onboard Data Collection System

- Intel Atom® x5-E3930 processor, up to 1.8GHz
- 4GB DDR3L memory (up to 8GB optional)
- 3x M12 GbE, 3x DB-9 Serial ports, 2x USB and one lockable HDMI port
- Storage: eMMC 5.0, 1x external accessible CFast slot
- Nominal power input voltage: 24VDC, 36VDC, 72VDC and 110VDC (EN 50155 compliant)
- -25°C to 70°C wide operating temperature range (EN 50155 class OT3)

MXE-210/MXE-210i Series



Ultra-compact IoT Platform with Intel Atom® E3900 Processor

- Equipped with Intel Atom® x7-E3950/x5-E3930 processors
- Compact fanless design: 140(W) x 110(D) x 58(H) mm
- Rich I/O & expansion: 1x DisplayPort, 2x USB 2.0, 2x USB 3.0, 2x GbE, 2x COM ports; 2x mPCIe slots, USIM slot, mSATA, Micro SD slot
- Optional 2.5" SATA SSD by storage kit, and eSIM support
- Built-in ADLINK SEMA management solution
- EN 50121-compliant, -20°C to +70°C wide operating temperature range

CompactPCI Serial (CPCI-S.0) Platforms & Peripherals

cPCI-A3525 New



3U CompactPCI Serial 8th/9th Gen Intel® Xeon®, Core™ i7, Celeron® Processor Blade with ECC

- PICMG® CPCI-S.0 CompactPCI® Serial Processor Blade
- 14nm up to 6 core 9th Gen Intel® processor, (formerly Coffee Lake Refresh)
- Max. 64GB DDR4-2666 by 2x SODIMMs
- Supports 2x PCIe x8 Gen 3 and 2x PCIe x4 Gen 3
- Up to 10x USB 2.0/3.0, up to 7x SATA to rear

cPCI-A3H10 New



3U CompactPCI Serial 2.5" SATA Storage Carrier

- 3U 4HP CPCI-S.0 peripheral
- One 2.5" SATA 6Gb/s drive slot
- Status LEDs on faceplate: drive activity, hot-swap status, user-configurable
- Hot swap support
- Operating temperature: -40°C to 85°C with qualified component

CompactPCI Platforms

cPCI-3630



3U CompactPCI Quad-Core Intel Atom® Processor X Series Blade

- Up to 8GB DDR3L-1600 ECC soldered memory and onboard up to 128GB SSD support
- Smart Embedded Management Agent (SEMA) for system health monitoring
- Optional GbE ports with MIL-STD M12 connectors
- EN 50155 compliant for railway safety-critical applications
- -40°C to +70°C fanless operation (up to +85°C with airflow)
- Minimum 10 years product life support

cPCI-3520 New



3U CompactPCI 8th/9th Gen Intel® Xeon®, Core™, Celeron® Processor Blade with ECC

- Up to 32GB DDR4-2666 soldered memory
- Supports three independent displays
- System/Peripheral slot operation
- Up to -40°C to +85°C operation
- Multi options storage interfaces incl. cFAST, SSD, mSATA, 2.5" SATA drive
- Flexible IO interfaces by mezzanine card selections
- Design for EN 50155 compliance

cPCI-A3X10 New



3U CompactPCI Serial XMC Module Carrier

- 3U 4HP CPCI-S.0 peripheral
- One XMC slot
- Operating temperature: -40°C to 85°C with qualified component

cPCI-3620



3U CompactPCI Quad-Core Intel Atom® Processor E3800 SoC Blade with ECC

- Outstanding performance and energy efficiency
- -40°C to +70°C fanless operation (up to +85°C with airflow)
- Optional GbE ports with MIL-STD M12 connectors
- VxWorks 5.5.1 support

cPCI-6540 New



6U CompactPCI 9th Gen Intel® Xeon®, Core™ Processor Blade with two PMC/XMC sites

- Dual channel DDR4-2666 memory, soldered and SO-CDIMM, up to 32GB
- Supports three independent displays
- Remote management and TPM support
- Extended temperature supported

CompactPCI Peripherals

cPCI-3E20 New



3U CompactPCI 4-Port M12 Gigabit Ethernet Card

- PICMG 2.0 R3.0 compliant
- Supports 32bit/33MHz CompactPCI bus
- Four M12 10/100/1000BASE-T ports on faceplate with isolation 1500V AC
- Four independent Intel® i210IT Gigabit Ethernet controllers
- Operating temperature: -40°C ~ +85°C
- OS support: Windows®10
- EN 50155 compliance
- Safety: UL 94V-0 and EN45545

cPCI-3W20-HW New



3U CompactPCI Mini PCIe carrier card

- PICMG 2.0 R3.0 compliant
- Supports 32bit/33MHz CompactPCI bus
- Support one Mini PCIe slot for LTE module (HUAWEI LTE module)
- Two SMA antenna connectors on front panel
- One DB-9 connector on front panel for PA control
- Operating Temperature: -40°C ~ +85°C
- EN 50155 compliance

cPCI-3548 New



8-Port RS-232/422/485 Isolated Serial Communications Card

- 32-bit CompactPCI®, PICMG® 2.0 Rev 3.0
- Plug-and-play, IRQ & I/O address automatically assigned by PCI BIOS
- Eight asynchronous communications ports with intelligent buffer
- Eight RS-232/422/485 ports
- 2500 VDC signal to ground isolation voltage
- Supports multiple OS
- Surge protectors
- Rugged DB37 connector

cPCI-7432/7433/7434



64-CH Isolated Digital I/O Modules

- 5000VRMS isolation voltage
- Sink current up to 500mA on each isolated output
- Rear I/O available on cPCI-7432R, 7433R, 7434R

cPCI-3E10/3E12



3U CompactPCI 2/4-Port Gigabit Ethernet Card

- 32-bit/33MHz, 66-bit/64MHz CompactPCI bus
- Two or four RJ-45 10/100/1000BASE-T ports on front panel
- Two LAN ports switchable to rear
- Optional LAN port via D-Sub connector

cPCI-3C10-MVB New



3U CompactPCI Mini PCIe carrier card for MVB

- PICMG 2.0 R3.0 compliant
- Supports 32bit/33MHz CompactPCI bus
- Support one Mini PCIe slot for Duagan MVB module D017M
- Two DB-9 connectors on front panel
- Operating Temperature: -40°C ~ +85°C
- EMC: EN 55022, IEC1000-4-2, IEC1000-4-4

cPCI-3544



4-Port RS-422/485 Isolated Serial Communications Card

- Plug-and-play, IRQ & I/O address automatically assigned by PCI BIOS
- Four asynchronous communications ports with intelligent buffer
- Four RS-422/485 ports
- 2500 VRMS isolation voltage

cPCI-7841



Dual-port Isolated CAN Interface Cards

- Two independent CAN network operation
- 2500 VRMS isolation protection
- Direct memory mapping to the CAN controllers
- PCI bus plug-and-play

CPGS-9120-M12-A / CPGS-9160-M12-A

EN 50155 12/16-port managed Gigabit Ethernet switch

- 4 or 8 Gigabit Ethernet ports on front in M12 connectors and 8 ports on rear
- O-Ring fast recovery technology
- Open-Ring / O-Chain network redundancy technology
- Configuration via web-based interface, CLI, and SNMP



ORing

Power Supplies

cPS-H325/WDC



3U CompactPCI 8HP Wide Input Range Power Module

- Input voltage range from 16.6 to 160VDC
- -40°C to +85°C operating temperature
- Hot-swap support for N + 1 redundancy
- Output power 120W (fanless) or 300W (forced air)
- Remote signal and degradation signal support

cPS-H325/AC



3U CompactPCI 8HP 250W AC Power Module

- Input voltage range from 90 to 264VAC
- 250W nominal output power
- Operating temperature -40°C to +70°C
- Internal ORing diodes for N + 1 redundancy
- Hot swappable
- Active current sharing

Systems

cPCIS-ET1100



3U 84HP CompactPCI Fanless Enclosure with 32-bit Backplane and Redundant Power Supply

- 19" 3U rack mount housing with 7 peripheral slots
- Comprehensive EMC shielding
- Equipped with wide temperature range CompactPCI redundant power supply (Max. output 500 W)
- Optional dual system segments, each with one system slot and five peripheral slots

cPCIS-3048



3U 48HP CompactPCI Fanless Enclosure with 6-slot Backplane and Redundant Power Modules

- 3U CompactPCI backplane with one system slot and five peripheral slots
- Suitable for rackmount applications
- 3U 48HP fanless enclosure
- Optional redundant CompactPCI power modules

Building AI's Pervasiveness throughout Rail with AI-enabled Video Analytics Platforms



A line of EN 50155 compliant AI-enabled platforms offer rail solution providers with a high level of flexibility to select the configuration best suited to their use cases, and help them achieve railway digital transformation

AVA-5500

Rugged, fanless AIoT platform with NVIDIA Quadro GPU embedded for real-time video/graphics analytics



AVA-5600

19" 2U rackmount rugged, fanless AIoT platform with high performance GPU for compute-intensive applications



AVA-RAGX

Compact, fanless AIoT video analytics platform with NVIDIA Jetson AGX Xavier for SWaP-constrained deployments



CompactPCI Platforms

Complete solutions consisting of high performance CPCI-S.0 processor/carrier blades, NVIDIA MXM GPU modules and CompactPCI systems



CompactPCI Serial Processor Blades



MXM GPU Modules



CompactPCI Systems

Why ADLINK?

By leveraging more than 25 years of expertise in developing highly reliable and available embedded computing systems, ADLINK is a premier supplier to the rail industry that offers not only an extensive, cost-effective, and standards-based COTS portfolio, but also a wide range of rugged fanless embedded computers and custom solutions enabled by its best-in-class ODM capabilities. ADLINK is committed to helping rail integrators and application developers focus on differentiating and transforming their end applications in train control, rail signaling, automation and digitalization. Moreover, ADLINK can help facilitate deployments for onboard and wayside applications as well as greenfield and brownfield projects, ultimately driving safer, smarter, and more reliable railway operations.



Technology Leadership

As a long-standing pioneer in embedded technologies, ADLINK drives industry standards and technology advancements with leading bodies, including the PCI Industrial Computer Manufacturers Group (PICMG), the PC/104 Consortium, and the VMEbus International Trade Association (VITA). ADLINK now brings its expertise in edge computing, IoT, AI, and machine learning technologies to enable a variety of new rail applications.



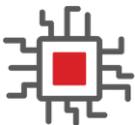
Extensive Portfolio

ADLINK is dedicated to continued development of its extensive, highly cost-effective, EN 50155-compliant COTS product portfolio. ADLINK's complementary product lines enable customers to deliver low total cost of ownership (TCO) with great flexibility in solution selection while addressing today's increasingly complex rail operations.



Strategic Partnership

Because ADLINK is a member of the Intel® IoT Solutions Titanium Partner and NVIDIA Elite Partner programs, the company can leverage unique access to the latest CPU and GPU technologies as well as the highest levels of technical support from Intel and NVIDIA.



Quality and Integrity

With world-class in-house manufacturing facilities, established quality management systems, and supply chain management (ISO-9000 and TL9000 certified), ADLINK ensures uncompromised military-grade quality, and equally importantly, fully controls product integrity and security, and is thus immune to any outside tampering.



Supply Longevity

ADLINK ensures best practices in working through product obsolescence and lifecycle management. We leverage strategic partnerships with key component and software vendors, delivering supply longevity to the support traditionally long lifecycle programs of the rail industry. ADLINK is a leading global supplier of field-proven CompactPCI solutions and actively invests in sustaining the technology to help rail integrators undertake system upgrades and technology insertions.



Business Flexibility

As an ODM powerhouse with a flexible and agile organization, ADLINK can effectively and efficiently address rebranding, customization, and joint development smoothly and promptly. ADLINK makes ease of doing business one of our top priorities and focuses on helping customers speed time-to-market for long-term mutual success.



Global Support

ADLINK is a global enterprise with a strategic footprint in design, manufacturing, and service worldwide. The company uses customer proximity to effectively deliver products to regional market specifications and requirements. This high-touch business model, which hinges on local technical and business services, is key to most rail programs.



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