



Product Catalogue

TCMS Products & Projects

Smarter trains. Better future.



A Warm Welcome to EKE-Electronics

For more than four decades, EKE-Electronics has been dedicated to helping train builders and operators run dependable, well-integrated fleets. Our long history in train automation has shaped how we design our systems today: with clarity, reliability, and long-term support at the centre of every decision.

The Train Control and Management System is at the heart of this approach. It brings together the functions that keep a train moving safely and efficiently, and it gives operators the tools they need to understand their fleet at every moment.

As you read this brochure, I hope you gain a clear picture of how our TCMS platform supports your goals: dependable operation, transparent system behaviour, and a structure that accommodates change when required.

Thank you for taking the time to learn more about our work. We look forward to supporting you and your teams on your upcoming projects.

Marko Mäkinen

Chief Executive Officer, EKE-Electronics Ltd.

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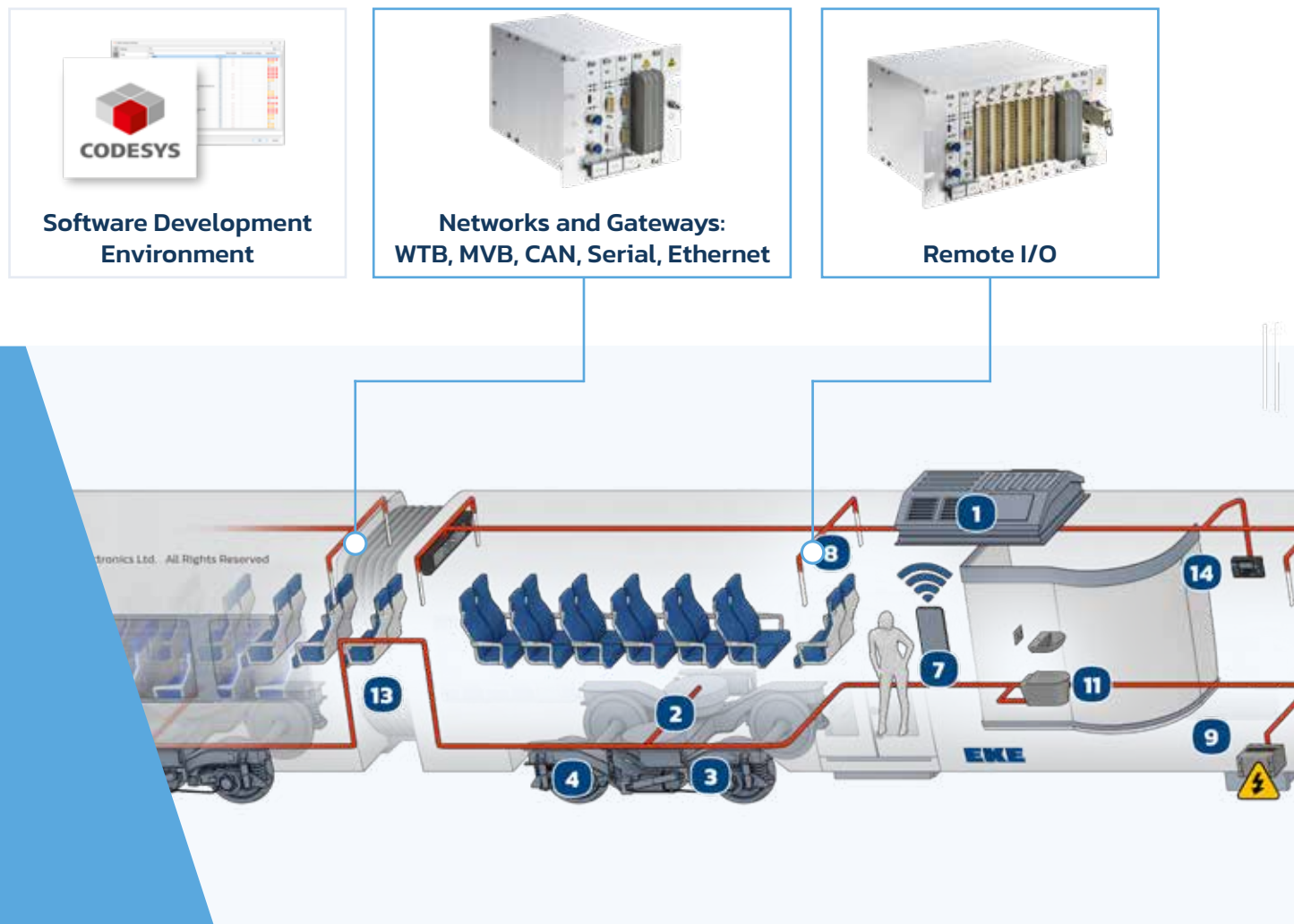
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The information provided in this brochure was accurate at the time of publication. However, EKE-Electronics reserves the right to make changes to products, specifications, and services without prior notice. Product illustrations are provided for reference purposes and may be representative of a product family rather than a specific product variant. We do not accept responsibility for any errors, omissions, or discrepancies that may be present in this document.

TCMS Platform

A Modular Architecture for Safe, Reliable Train Control

The EKE-Trainnet® Train Control and Management System (TCMS) is not a single product but a coordinated family of systems, including Vehicle Control Units, Gateways, Remote I/O and Event Recorders, designed to be combined as needed to match each train's technical architecture. This modularity allows each project to include only the required elements while maintaining a consistent platform, with redundancy options ranging from duplicated modules to full dual rack configurations.



EKE-Trainnet® TCMS for the monitoring, control and/or automation of:

- | | | |
|------------------|----------------|------------------------------------|
| 1 HVAC | 7 Diagnostics | 13 Train integrity & configuration |
| 2 Bogie/Wheelset | 8 Lights | 14 Emergency communications |
| 3 Brakes | 9 Batteries | 15 Data protection |
| 4 Traction | 10 CCTV | 16 Train-to-wayside communications |
| 5 ETCS/ATC/ATO | 11 Water tanks | |
| 6 PIS/PA | 12 Doors | |

Cybersecurity/CRA Ready

The TCMS platform is designed with cybersecurity as a core requirement, supporting a secure-by-design approach. A cryptographically verified secure-boot chain ensures that only trusted, approved software can run on the device. The overall architecture aligns with IEC 62443-4-2 Security Level 2 and supports compliance with the EU Cyber Resilience Act, helping operators meet evolving cybersecurity requirements.



SIL Safety Applications

Proven Track Record

At EKE-Electronics, we boast a proven track record of developing systems up to SIL 2 across diverse safety functions. Leveraging our wealth of experience and a comprehensive process adhering to standards such as EN 50126, EN 50129 and EN 50716, we have established a robust framework for developing and testing safety applications.

Cybersecurity/CRA Ready

Our SIL Safety Applications are designed with cybersecurity as a core requirement, supporting a secure-by-design approach. A cryptographically verified secure-boot chain ensures that only trusted, approved software can run on the device.



The overall architecture aligns with IEC 62443-4-2 Security Level 2 and supports compliance with the EU Cyber Resilience Act, helping operators meet evolving cybersecurity requirements.

Existing Functionalities

Our existing safety applications cover a wide range of train control, monitoring, and safety functions, which can be tailored to specific project requirements.

By leveraging these pre-developed, validated solutions, we provide cost-effective and efficient integration, ensuring compliance with SIL standards while accelerating project timelines.

Testing and Documentation

EKE-Electronics ensures the reliability of SIL safety applications through extensive testing and thorough documentation. We produce detailed test reports, verification records, and safety cases, providing clear traceability and evidence of compliance.

This meticulous approach supports the safe and dependable operation of our solutions.

Can't See Your SIL Application Listed?

We have only listed a selection of some of the safety applications that we have developed for customers. If you have a specific requirement, get in touch to find out how we can help.

Automatic Selective Door Operation



Automatically assesses the train's alignment with the station and platform setup, granting activation solely to doors that can be safely opened. RIS-2747-RST.

On-Board Hot Axle Box Detection



Continually monitors the axle box and gearbox temperature and issues warnings if the measurements vary from normal. EN 15437-2.

Lateral Acceleration Monitoring



Measures lateral vibrations and sends notifications about abnormalities or automatically stops the train in immediate danger.

Vigilance Control System



Continually monitors the train driver's vigilance and automatically stops the train if the system pedal/button is not periodically pressed.

Safety Communication Management System



Centrally managed networked safety functions to ensure safe data communication throughout the train.

Supervision of Traction Enabling



Checks conditions that must be fulfilled to enable the traction, e.g. driver's cab occupied, no speed (null speed signal on), doors are closed.

Fire Detection Subsystem Monitoring



Reads fire detection signals from locomotives and coaches and displays the information to the train crew.

Supervision of Passenger Alarm Activation



Receives the activation of the passenger alarm when the train is at the platform or when leaving the platform.

Train Speed and Distance Monitoring



Analysis of several speed measurements and display of the value to the train crew.

Brake Pipe Pressure Monitoring



Informs the driver of the status of the main brake pipe pressure and if necessary, activates the protective actions.

From Idea to Implementation

A Structured Approach

Whether you are designing a new system, upgrading an existing system or introducing new SIL 2 functions, we provide support throughout the entire process, from selecting the right hardware to developing custom software applications.

Initial Consultation

1

Your journey with us begins when you share requirements for TCMS. Our team will work closely with you to understand your project's goals and constraints, ensuring that we align with your technical needs.

System Selection

2

Based on the initial consultation, the right modules are selected from our range. Multiple systems can be integrated into a single rack to optimise space and efficiency.

Software Development

3

Once the hardware has been selected, the software application is developed to deliver the required system functionality. Depending on the project scope, EKE-Electronics can train your engineers or deliver a complete solution.

Project Support

4

We can provide project support services to ensure the seamless integration and implementation of our solutions.

Technical Support and Training

5

EKE-Electronics provides remote technical support via our customer portal, with on-site expert support available when needed. We also offer tiered training for partners and EKE-Trainnet® users, delivered online or in person.

After Sales Support

6

Our After Sales Support provides ongoing assistance throughout the product's lifecycle.

Straightforward Installation & Diagnostics

All modules in our systems have front-facing connectors, making installation and maintenance straightforward. Built-in visual diagnostics support maintainers through front-panel LEDs that show module health, application activity, connection status, and error conditions. These indicators help teams identify issues quickly without specialized tools and reduce downtime.

Transition from ISaGRAF to CODESYS®.

EKE-Electronics is replacing its existing ISaGRAF environment with CODESYS®. The transition is supported with migration services for existing ISaGRAF applications and we continue to provide support for C-based applications. To facilitate migration, EKE-Electronics offers a dedicated migration tool and training services.



Develop Your Own TCMS Applications

We support OEMs and integrators in developing their own TCMS applications, ensuring train functions align with vehicle design and operational needs throughout the lifecycle. To enable this, we provide an open, Linux-based development environment based on CODESYS®. This IEC 61131-3 standard platform supports all major programming languages, allowing flexible integration and long-term maintainability.

Space-Efficient Rack Formats

EKE-Electronics' TCMS systems are available in multiple rack formats, including front-mounted, side-mounted and flat racks for space-constrained installations such as trams and refurbishment projects. This allows installation in both standard cabinets and restricted areas without loss of functionality. All formats support standard and SIL 2 safety functions.



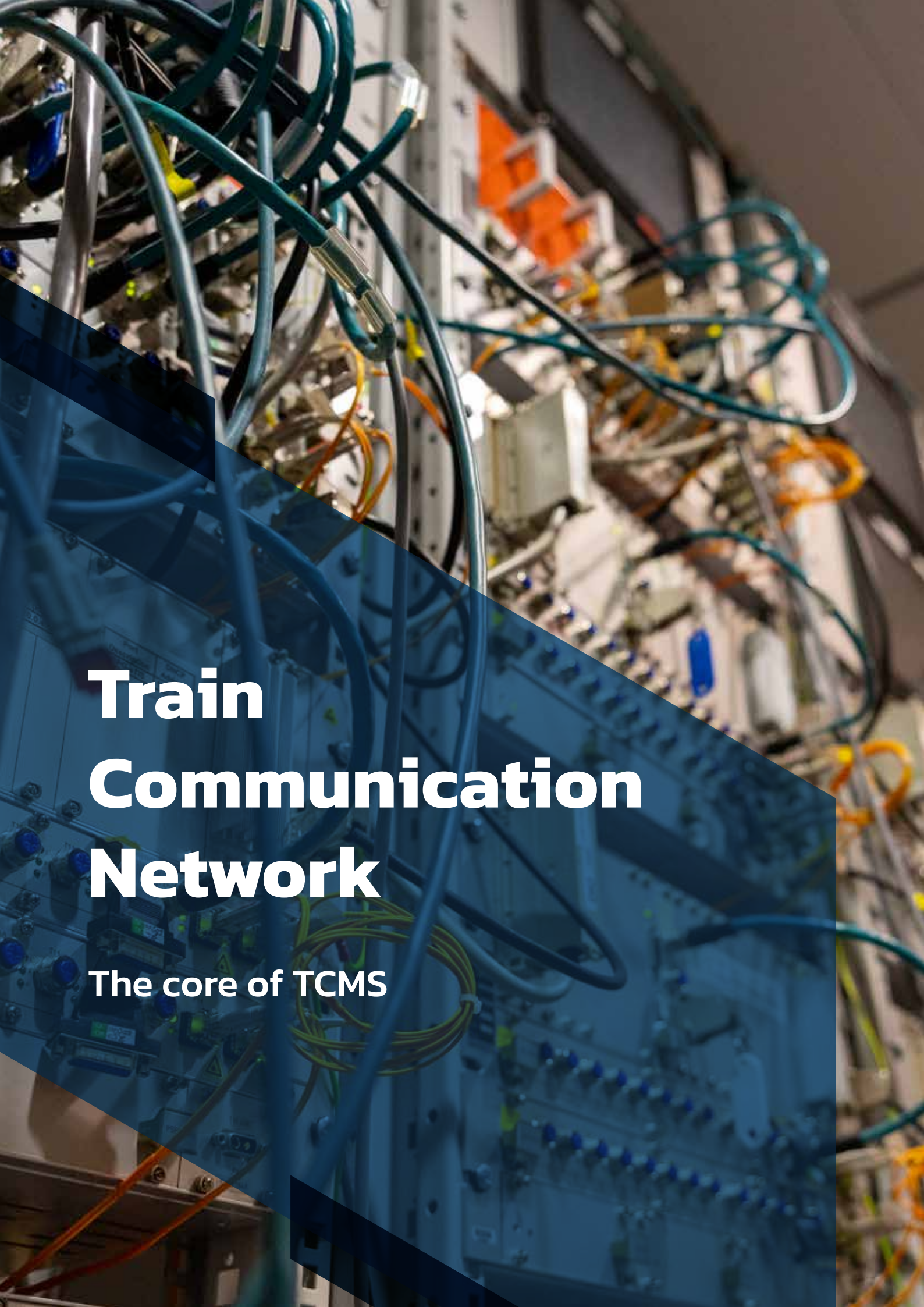
Standard Racks



Side Mounted Racks



Flat Racks

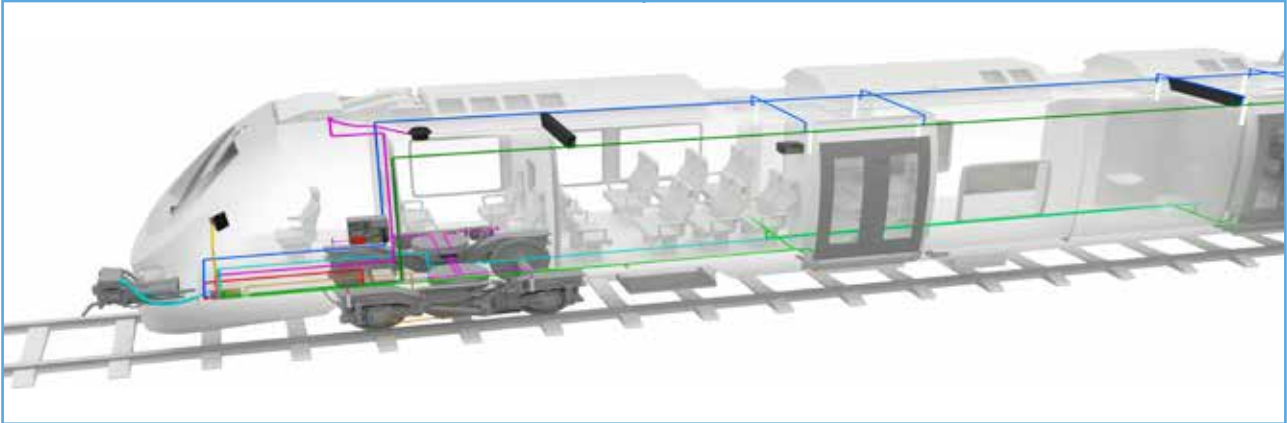


Train Communication Network

The core of TCMS

Overview

The EKE-Trainnet® Train Communication Network (TCN) is the foundation of the TCMS. It complies with the IEC 61375 Series and provides the communication layer that links every subsystem across the train. All components exchange data through one shared network or several coordinated networks when the project requires it. This unified structure enables centralized control and predictable system behaviour.



Example TCN Architectures

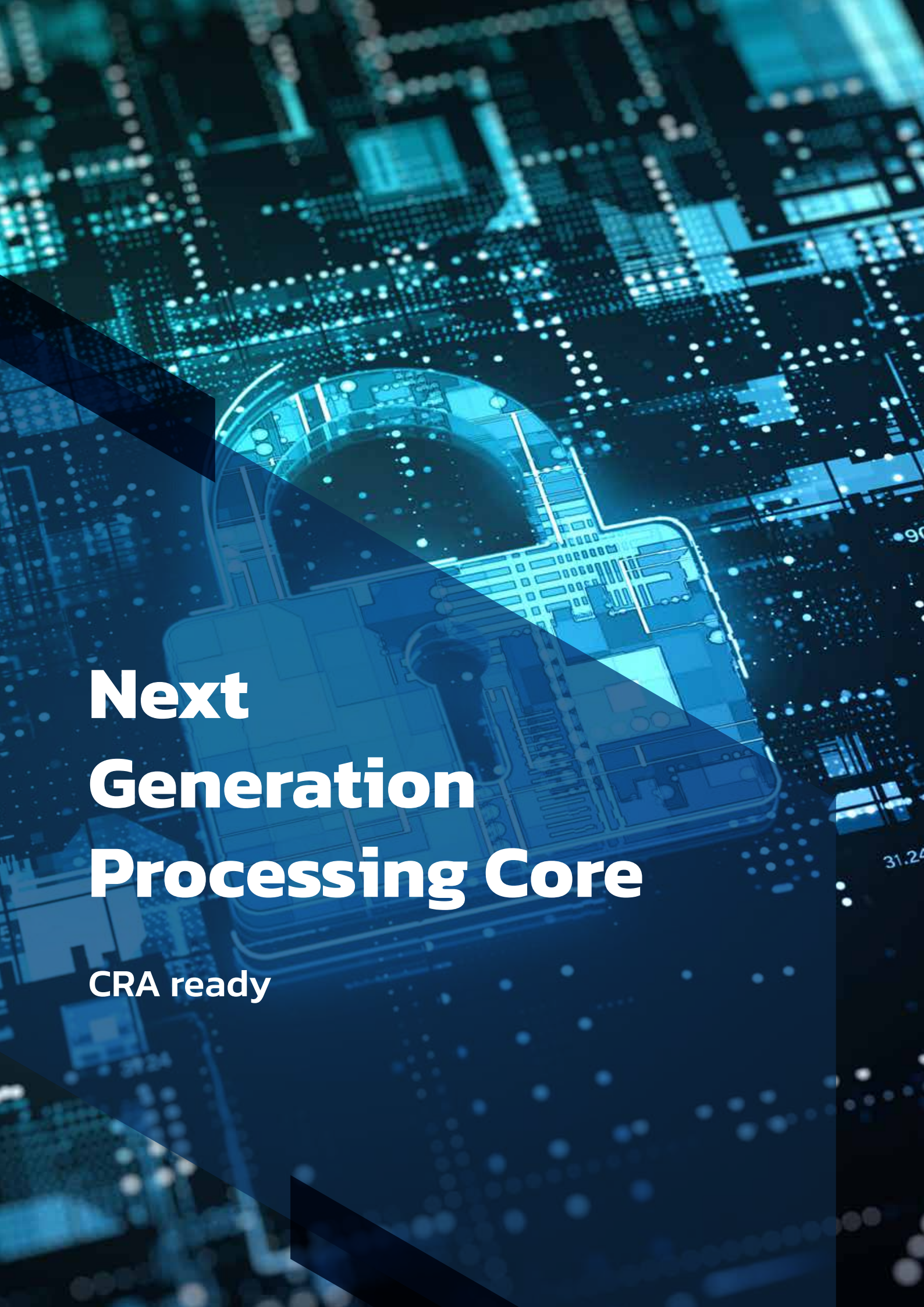
EKE-Trainnet® supports a wide range of TCN configurations. These include:

- | | |
|-----------------------------------|-----------------------------------|
| ✓ Dual Homing Ethernet interfaces | ✓ WTB-MVB standard bus redundancy |
| ✓ TRDP over Ethernet | ✓ Ethernet-WTB-MVB Hybrid |
| ✓ Ethernet-WTB-MVB | ✓ CAN-WTB |
| ✓ Ethernet-MVB Hybrid | ✓ Full MVB or CAN train networks |

These examples illustrate the scalability and flexibility of the platform. They are not exhaustive but show how the architecture adapts to different operational and technical requirements.

Dual-Homing, TRDP & SDTv2 Included

The platform supports a dual homing network topology to provide redundancy and high availability in operation. It supports the TRDP protocol enabling data exchange between devices from different manufacturers on Ethernet networks. SDTv2 (Safe Data Transmission version 2) is supported together with TRDP to enable the safe transmission of safety related data over Ethernet/IP train networks. This provides integrity protection and fail-safe behaviour when standard TRDP alone does not meet safety requirements.

The background is a high-magnification, blue-tinted image of a microchip. A specific processing core is highlighted with a semi-transparent blue overlay and red lines, showing its internal circuitry. The overall aesthetic is futuristic and technological.

Next Generation Processing Core

CRA ready

CPU6000 Series

All our TCMS systems are based on our latest high-performance CPU6000 Series, providing state-of-the-art cybersecurity features and serving as the processing core of our next-generation platform.

A cryptographically verified secure-boot chain ensures that only trusted, manufacturer-approved software runs on a device.



CPU6000

For complex applications requiring high processing power



CPU6010

For typical TCMS applications



CPU6030

For RIOM and Gateway applications

Scalable CPU Range for Optimal Fit

The CPU6000 Series offers a scalable selection of processing options, from high performance multicore units to cost optimized single core modules. With multiple performance variants, you can select exactly the processing capability each system requires. This avoids unnecessary cost or over specification while ensuring the system remains efficient, scalable and well matched to the requirements of different train designs.

CRA Ready

Secure-by-design in accordance with the Cyber Resilience Act (CRA), Regulation (EU) 2024/284.



Cyber Secure

Meets railway-specific requirements defined in the upcoming IEC 63452. Supports up to Security Level 2.



SIL 2 Certified

Certified to SIL 2 according to EN 50129 and EN 50716.



SDTv2 & TRDP

Supports SDTv2 (Safe Data Transmission) and implements TRDP.



Dual Homing

Dual homing as standard.



GoA4

Capable of Grade of Automation (GoA) up to Level 4 in compliance with EN 62290.



A person with short brown hair, seen from the back, wearing a black headset with red accents. They are sitting at a desk in a call center, with a computer monitor visible in front of them. The background is slightly blurred, showing other workstations and a person in the distance. A large, dark blue diagonal graphic element covers the lower-left portion of the image, serving as a background for the text.

Customer Support

Lifecycle support service

Project Support

EKE-Electronics is uniquely positioned to assemble project teams tailored to meet the specific requirements of each customer. Dedicated project and support teams, based at our headquarters in Espoo, Finland and Shanghai, China, have experience in delivering TCMS solutions to over 150 train fleets and to a wide variety of train builders around the world. This wealth of knowledge and expertise ensures exceptional support for every project.

Our project teams are flexibly scaled to match the size, complexity and phase of each project. This approach enables us to efficiently deliver solutions for both new train fleets and retrofit projects.

After-Sales Support

Implementing a TCMS system is only the beginning. Maintaining performance, reliability, and compliance throughout the vehicle lifecycle requires ongoing technical support from a partner who understands the architecture, application and operational environment.

Lifecycle Support Service



Long-term product support ensures continued access to technical expertise, repairs, spare parts, and troubleshooting services. Our commitment helps customers navigate through product obsolescence concerns and maximize the value of their investment throughout the system lifecycle.

Technical Support



Expert assistance for troubleshooting, fault analysis, software updates, and configuration changes. Our engineers help resolve issues quickly and ensure systems continue to perform as intended.

Lifecycle Upgrades



As operational requirements evolve, we support software enhancements, vehicle modifications, and system updates, helping customers extend functionality and maintain performance throughout the vehicle lifecycle.

Remote & On-Site Assistance



Remote support enables rapid response to technical issues, while on-site assistance can be provided for commissioning, investigations, upgrades, and maintenance activities when required.

Service Agreements



Service agreements can be tailored to meet your operational needs through defined response times, technical support, maintenance services, and obsolescence management.

With decades of experience in train control, EKE-Electronics delivers dependable long-term support that helps customers protect their investment, maintain operational readiness, and keep vehicles running safely and efficiently for years to come.

A group of people are gathered around a large screen in a training room. The screen displays a technical diagram with various lines and components. One person is pointing at the screen, while others are looking on. The room has large windows with blinds in the background. A dark blue diagonal overlay covers the bottom half of the image, containing the text.

Training and Capability Development

**Building the skills to develop, maintain
and evolve TCMS applications**

Enabling Long-Term Customer Success

EKE-Electronics believes customers should have the ability to configure, develop and maintain their own applications. Our training programmes are designed to transfer knowledge, build confidence and develop in-house expertise, allowing organizations to take greater ownership of their systems while reducing reliance on external support.

Training is available at both basic and advanced levels and can be tailored to suit the customer's experience, project requirements and application objectives. Sessions may be delivered on-site or remotely and combine theoretical learning with practical exercises to ensure participants can apply their knowledge in real engineering environments.

A Practical Approach to Learning

Our training combines several teaching methods to maximise understanding and knowledge retention:

Theoretical Instruction



Structured sessions covering system architecture, functionality, engineering principles and best practices.

Collaborative Learning



Team-based exercises encourage problem-solving, discussion and shared understanding among participants.

Hands-On Exercises



Participants work directly with development tools, software and hardware to gain practical experience in a controlled environment.

Live Demonstrations



Experienced EKE engineers demonstrate tools, workflows and system behaviour, providing practical insight into real-world operation.

Case-Based Learning



Real project examples and application scenarios help participants apply their knowledge to practical challenges, improving confidence and accelerating skill development.

From Fundamentals to Advanced Development

Training programmes can cover topics such as:

- ✓ TCMS architecture and system concepts
- ✓ Hardware platforms and system configuration
- ✓ Application development and testing
- ✓ Diagnostics and troubleshooting
- ✓ Communication interfaces and networks
- ✓ Maintenance and lifecycle support
- ✓ Project-specific workflows and best practices



Vehicle Control Units

**High performance for complex
applications and GoA4 trains**

Overview

The EKE Trainnet® Vehicle Control Unit (VCU) is a powerful, high-performance computer for train automation. It controls and coordinates the functions of each coach or the whole train. It communicates with subsystems, runs control applications, and provides diagnostics to support reliable operation.



VCU



Integrated VCU with ESN Dongle

Key Features

High Performance



The high performance VCU provides high data throughput, supporting real-time control, stable system behaviour, and efficient handling of complex train functions.

CRA Ready



Secure-by-design in accordance with the Cyber Resilience Act (CRA), Regulation (EU) 2024/284 and IEC 62443-4-2 cybersecurity requirements up to Security Level 2.

Dual Homing



Two redundant Ethernet interfaces that keep communication running even if one network path fails.

Integrated Local I/O Capability



Combine vehicle control and local I/O in a single compact rack allowing one processor to run both the VCU functions and the I/O handling.

Multiple Bus Interfaces Supported



WTB, MVB, CAN, Serial Links and Ethernet supported.

GoA4



Capable of Grade of Automation (GoA) up to Level 4 in compliance with EN 62290.

Example Applications

1

SIL 2 Monitoring and Control System

The VCU works as the central SIL 2 control unit. It operates together with redundant SIL 2 Remote I/O modules installed in the powerheads and coaches. These modules collect temperature, pressure, acceleration and status signals from sensors across the train. The VCU and the I/O modules exchange data using a safety-certified MVB protocol. The system supervises key functions and runs dedicated test routines. Together, the VCU and the Remote I/O modules form a complete SIL 2 control and monitoring system that scales across a full train formation.

2

Fault Logs

In previous TCMS projects, the VCU has been configured to implement fault logging logic at both vehicle and train level. The application monitored key subsystem signals and, when predefined fault conditions were detected, applied logs to inhibit further operation of affected functions. For example, traction commands were blocked following critical faults, and reset conditions were managed through defined recovery sequences. Fault states and conditions were recorded and made available for diagnostics via the VCU.

3

Traction, Propulsion, and Braking Control

The VCU has been used to process driver input signals and coordinate both traction/propulsion and braking functions across the train. In these implementations, the VCU calculated traction demand and transmitted power, brake, and direction commands to traction and brake control units via the train communication network. Control logic also handled transitions between traction and braking states, ensuring consistent behaviour under varying operating conditions. Safety-related interlocks were implemented, such as preventing traction enablement until defined conditions were confirmed, and initiating braking actions when required by system status or fault inputs.

Cybersecurity

Our Vehicle Control Units use a cybersecurity architecture that meets IEC 62443-4-2 Security Level 2 and aligns with EU Cyber Resilience Act principles for secure-by-design operation.

The platform is built on the same next-generation CPU line used across the TCMS family, providing a hardened processing environment designed to resist tampering and unauthorized software through a cryptographically protected secure-boot chain.

Combined with secure communication methods, controlled access, and long-term lifecycle support, the VCU provides a dependable and trustworthy base for secure train control.

Specification



Technical Data

Minimum rack size:

87 mm × 229 mm × 215 mm

Minimum weight:

1.21 kg + module weight

Input voltage:

24 V DC and 110 V DC

Operational temperature:

–40 °C to +70 °C

Supported interfaces:

WTB, MVB, CAN, Serial Links, Ethernet

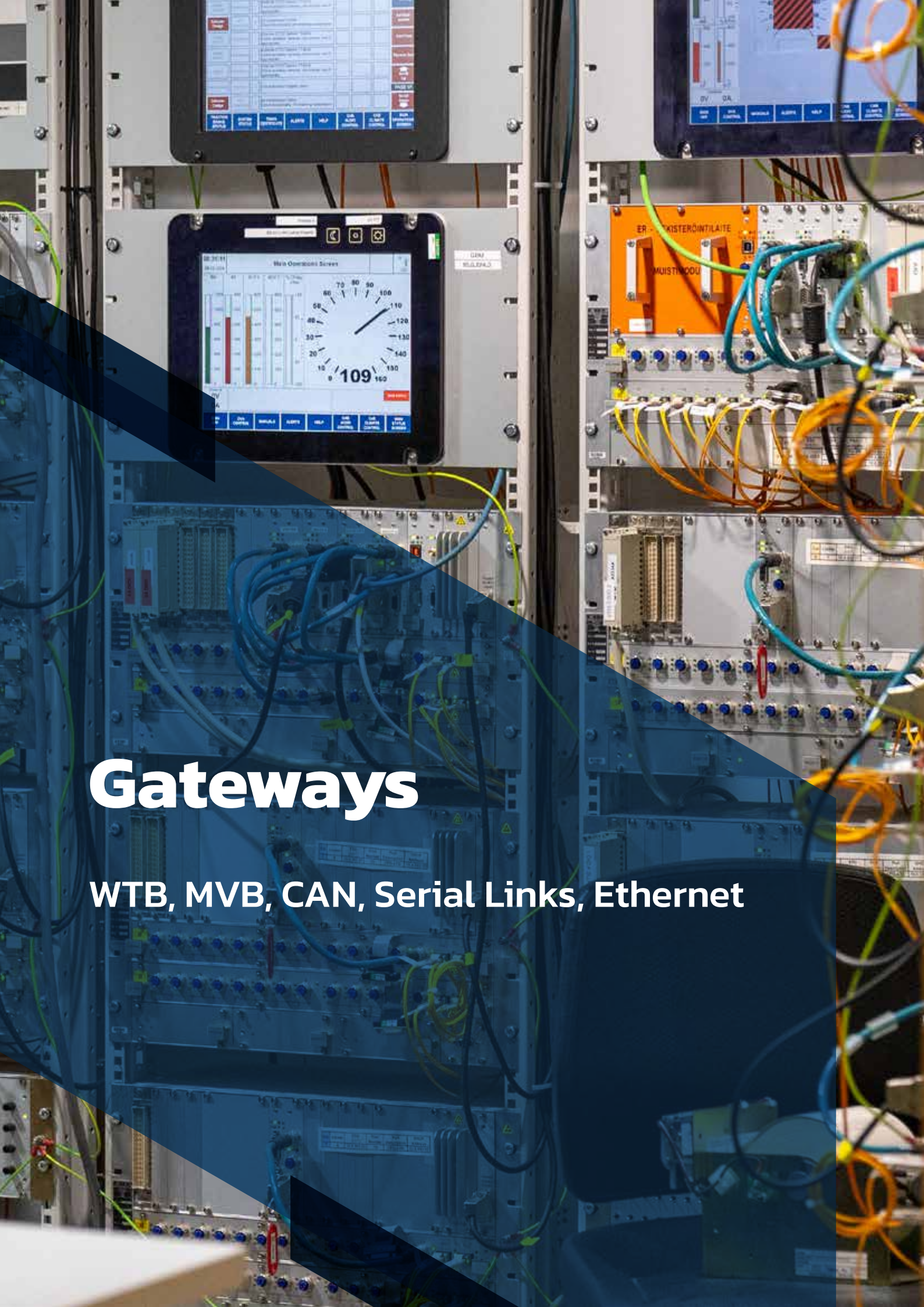
Supported I/O modules:

- ✓ Digital Input/Output
- ✓ Digital Relay Output
- ✓ Analog Input/Output
- ✓ High-Speed Analog Input
- ✓ Pt100/Pt1000 Temperature Sensor Input
- ✓ Temperature Sensor Input



Compliance

- ✓ EN 50155
- ✓ EN 45545
- ✓ IEC 61131-3
- ✓ IEC 62443-4-2 up to SL 2



Gateways

WTB, MVB, CAN, Serial Links, Ethernet

Overview

The EKE-Trainnet® Gateway is a modular train computer designed to bridge different on-board networks. It enables subsystems using different protocols to exchange data reliably and on time.



Gateway in standard rack



Gateway in side mounted rack

Key Features

Cyber Secure Processing



The CPU6000 Series provides a robust and secure processing platform for gateway applications, delivering reliable protocol routing and dual homed Ethernet communication with long-term maintainability and efficiency.

Reduced Hardware



A wide range of bus interface modules can be integrated with other modules such as a Rugged Memory Module and I/O modules into the same rack to build a compact and cost-efficient train computer.

ETCS/ATO Integration



Our Gateway variants include an ETCS/ATO configuration with the standard interfaces defined in Subset-119 and Subset-139. This setup supports the integration of signalling and automation systems.

Vehicle Control Capability



With the appropriate modules, Gateway products can also function as Vehicle Control Units, combining gateway and control functions on a single platform to reduce hardware and simplify system architecture.

CRA Ready



Secure-by-design in accordance with the Cyber Resilience Act (CRA), Regulation (EU) 2024/284 and IEC 62443-4-2 cybersecurity requirements up to Security Level 2.

Multiple Bus Interfaces Supported



WTB, MVB, CAN, Serial Links and Ethernet supported.

Example Applications

1

Gateways for Modernisation Projects

EKE-Trainnet® Gateways are used in our modernisation projects to connect legacy systems, often serial-based, with new Ethernet-based TCMS components.

2

ATO Adapter for GoA2 Applications

Our EKE-Trainnet® Gateway acts as the ATO Adapter for GoA2 by linking the ATO-on-board system with the train's existing control and communication networks. It manages the data exchange and provides a controlled interface between ETCS, ATO and the vehicle. This allows operators to add GoA2 functions to fleets without changing the core TCMS software.

The Gateway handles traction, braking and door-related signals through its flexible I/O and network interfaces, giving a reliable bridge for automated stopping and speed control. This makes it a practical choice for projects that need GoA2 capability on legacy fleets.

3

ETCS Train Interface Unit / CBTC On-Board Controller

The EKE-Trainnet® Gateway has been used as a flexible interface module that links both the ETCS on-board unit and the CBTC on-board Controller with the various legacy systems found on many trains. It handles data exchange between different network types and maps signals so that each subsystem receives the correct information. The unit forwards data between networks, filters traffic and enforces access controls to protect safety critical communication. This approach allows operators and integrators to upgrade fleets with new functions while keeping the existing vehicle architecture unchanged.

Cybersecurity

All our Gateways use a cybersecurity architecture that meets IEC 62443-4-2 Security Level 2 and aligns with EU Cyber Resilience Act principles for secure-by-design operation.

The platform is built on the same next-generation CPU line used across the TCMS family, providing a hardened processing environment designed to resist tampering and unauthorized software through a cryptographically protected secure-boot chain.

The platform supports intrusion-detection features for proactive monitoring of potential threats. Combined with secure communication methods, controlled access, and long-term support, it provides a reliable and trustworthy base for secure on-board networking.

Specification



Technical Data

Minimum rack size:

87 mm × 229 mm × 215 mm

Minimum weight:

1.21 kg + module weight

Input voltage:

24–110 V DC

Operational temperature range:

–40 °C to +70 °C

Supported bus types:

- ✓ WTB
- ✓ WTB
- ✓ MVB
- ✓ CAN
- ✓ Serial Links
- ✓ Ethernet



Compliance

- ✓ EN 50155
- ✓ EN 45545
- ✓ IEC 61375 Series
- ✓ IEC 61131
- ✓ IEC 62443-4-2 up to SL 2



Remote I/O Systems

**High I/O density with mixed SIL and
non-SIL applications**

Overview

The EKE-Trainnet® Remote I/O System is a configurable system that connects vehicle subsystems to the Train Control and Management System. Distributed digital and analog inputs/outputs (I/O) are provided within the vicinity of the I/O source. The Remote I/O System can be used as an alternative to connect I/O sources directly to the train computer leading to reduced cabling and cost savings.



Remote I/O with ESN Dongle

Key Features

Optimized CPU for Remote I/O



Purpose built for Remote I/O roles, our next-generation CPUs provide the right balance of interfaces and processing performance, ensuring reliable connectivity and dependable exchange of I/O signals across distributed train control systems.

Dual Homing with TRDP



Dual homing with TRDP connects each RIOM to two independent Ethernet paths, ensuring continuous real-time I/O data flow even if a link or device fails. Optional SDTv2 support is available enabling SIL 2 capable data transmission for safety-critical applications.

High I/O Density



Up to 576 digital I/O channels in a single unit support high signal density while reducing hardware and simplifying system design.

Flexible I/O Support



A range of analog and digital I/O is supported, allowing the system to interface with a wide variety of on-board signals.

Mixed Non-SIL and SIL Applications



SIL 2 and non-SIL modules can co-exist in one Remote I/O system, reducing the number of racks, power feeds, and field connections required through shared hardware.

Application-Ready I/O Platform



Application logic can run directly on the Remote I/O system, improving response times, reducing data transfer, and lowering system complexity by minimizing the need for additional computing hardware.

Example Applications

1

SIL 2 Remote I/O

The SIL 2 Remote I/O provides safety-related monitoring and control functions within the vehicle. All measurement, monitoring, and diagnostics data is transferred to the safety gateway over MVB using SDTv2 messaging, while non-safety data is shared with the vehicle control unit at SIL 0 level.

The architecture is fully redundant: two CPU processors exchange measurement and diagnostics information over a dedicated Ethernet link to maintain continuous availability of all safety-related monitoring tasks.

2

TRDP for Ethernet Trains

EKE-Electronics' Remote I/O has been successfully applied as a TRDP-based remote I/O solution within Ethernet train networks. Each Remote I/O collects digital and analog inputs from local equipment and communicates this data over Ethernet using TRDP messaging, enabling deterministic, real time data exchange across the train. Standardized multicast and unicast TRDP communication allows input states and output commands to be efficiently shared between subsystems, while the use of Ethernet connectivity simplifies integration into the Ethernet Train Backbone and consist networks.

3

CBTC Controller

The CBTC controller is supplied as a dedicated on-board unit that interfaces between the CBTC system and the train's TCMS. It processes CBTC-related data, manages communication over Ethernet-based train networks, and distributes information to other on-board systems through gateways and distributed I/O. The controller handles real-time data exchange using TRDP and supports redundant Ethernet connections to maintain availability.

Built on a SIL 2 certified, multi-core platform, it separates application and safety processing and provides a stable environment for CBTC functions within the wider train control architecture. This allows CBTC subsystems, vehicle control functions, and distributed I/O to operate together as part of a single, integrated TCMS.

Cybersecurity

Our Remote I/O Systems use a cybersecurity architecture that meets IEC 62443-4-2 Security Level 2 and follows EU Cyber Resilience Act principles for secure-by-design operation. This approach protects firmware, applications and configuration data throughout the lifecycle, supported by controlled and CRA-compliant update processes.

Access control restricts configuration changes and application downloads, while operational and engineering interfaces remain separated to reduce exposure. Security-event logging supports maintenance teams by providing clear records for diagnostics and incident analysis, helping operators maintain secure and dependable distributed I/O performance.

Specification



Technical Data

Minimum rack size:

280 mm × 133 mm × 215 mm

Minimum weight:

2.3 kg + module weight

Input voltage:

24–110 V DC

Operational temperature range:

–40 °C to +70 °C

I/O Module data:

- ✓ Digital Input/Output Module (DIO):
24 Input channels, 8 input/output channels
- ✓ Digital Relay Output Module (DRO):
up to 8 relay outputs
- ✓ Digital Solid State Outputs (DSO):
8 solid state outputs (only available by request)
- ✓ Analog Input Module (AIM):
10 voltage channels, 10 current channels
- ✓ Analog Input Module (AIO):
up to 16 voltage channels
- ✓ Analog Output Module (AOM):
16 output channels
- ✓ High Speed Analog Input Module (HSA):
4 voltage channels, 4 current channels
- ✓ Pt100/Pt1000 Temperature Sensor Input (PTI):
up to 6 measurement channels
- ✓ Temperature Sensor Input Module (TSI):
up to 6 measurement channels



Compliance

- ✓ EN 50155
- ✓ EN 45545
- ✓ IEC 62443-4-2 up to SL 2



Event Recorder / Train Data Recorder

On-board data recording

Overview

The EKE-Trainnet® Event Recorder, also known as a Train Data Recorder, is an on-board data logging system designed to capture and store operational and safety-critical information. It records analog, digital, positional and performance-related data needed for regulatory compliance and engineering analysis.

The Event Recorder can be used to meet mandatory recording requirements and enable reliable post-incident investigation. The platform is built on a modular architecture that supports only the signals required for the project, avoiding unnecessary data capture.



Event Recorder

Juridical Event Recorder also available

Key Features

Higher Processing Capacity with Support for SIL 2 Functions



Next-generation CPUs provide increased processing headroom for multi-stream data capture, with support for SIL 2 capable functions and dual homed networking.

Configurable, Continuous Data Capture



Continuous data recording ensures complete and reliable data capture, with configurable logging intervals and event-based triggers to record the required level of detail.

Crash-Protected Rugged Memory



A crash-proof rugged memory module protects data in a fire-insulated, reinforced structure, keeping it intact under impact, fire, liquids, and magnetic exposure.

Fast Data Access and Analysis



The TIP Tool enables fast download and analysis of Event Recorder data, with clear visualisation and tools to identify, compare, and export data for diagnostics.

Smart Cyclic Storage



Cyclic data storage automatically overwrites older records, while event-triggered locking preserves critical data, with flexible memory capacity.

Example Applications

1

Train Data Recorder for London Underground

EKE-Electronics supplies train data recorders for multiple London Underground lines, where they support daily operations and long-term fleet management. These systems capture operational signals, including brake controller interfaces and performance-related data, and store them in rugged memory modules designed for demanding metro environments. The recorders are used across fleets such as the Central line (85 trains, 680 cars) and Bakerloo line (36 trains, 252 cars), where they enable reliable post-incident analysis and provide engineering teams with dependable data for maintenance planning.

2

Video Capture

The EKE-Trainnet® Event Recorder has been applied in multiple projects to capture operational data together with video streams from the train. In several implementations, the system has been configured to record on-board CCTV, providing a time aligned view of passenger areas alongside system signals and events. Front facing video cameras have also been integrated to capture the driver's view outside the train. These recordings allow engineers to assess external conditions, for example during unexpected stops or signalling irregularities, and compare them with recorded system behaviour.

3

ETCS JRU (Juridical Recording Unit)

The EKE-Trainnet® Event Recorder has been applied in ETCS projects as a Juridical Recording Unit (JRU), where it captures safety-critical signalling data from the on-board ETCS system. In these implementations, the system is configured to record data directly from the European Vital Computer (EVC) as well as from national control interfaces such as the Specific Transmission Module (STM), providing a consistent record of signalling behaviour across different operating environments.

Cybersecurity

The Event Recorders gain their cybersecurity strength from the next-generation CPUs. These CPUs provide a secure foundation that aligns with IEC 62443-4-2 requirements to SL 2 and the expectations of the EU Cyber Resilience Act. The platform gives the Event Recorder stronger protection for data handling, communication interfaces and overall system integrity.

The hardened execution environment and long-term support help ensure that operational and safety-critical information remains trustworthy. These cybersecurity measures work alongside the unit's SIL 2 capable architecture, supporting safe operation without adding unnecessary complexity to system integration.

Specification



Technical Data

Minimum rack size: 87 mm × 229 mm × 215 mm

Minimum weight: 1.21 kg + module weight

Operational temperature range: -40 °C to +70 °C

Input voltage: 24–110 V DC

Rugged Memory Module (RMM): RMM 84TE only

Connectivity:

1 Ethernet M12

3 x RS-485

Power supply cabling:

Front (ER 44TE, ER 84TE, RMM 84TE)

Back (ER Flat 3U x 12TE, ER 20TE, ER Flat 6U x 12TE)

Options for side mounting:

ER 44TE, ER 84TE, RMM 84TE

Optional bus & I/O interfaces:

ER Flat 3U x 12TE: No free slot

ER 20TE: 2 free slots for: MVB, CAN, SIU and/or AIM*, HSA, DIO*, DRO*, AOM*, PTI*

*max of 1 module

ER Flat 6U x 12TE: 3 free slots for: MVB*, CAN*, SIU* and/or AIM, HSA*, DIO, DRO, AOM, PTI

*max of 1 module

ER 44TE: 7 free slots for: MVB, CAN, SIU and/or AIM*, HSA, DIO*, DRO*, AOM*, PTI*

*max of 5 modules

ER 84TE: 17 free slots for: MVB, CAN, SIU and/or AIM*, HSA, DIO*, DRO*, AOM*, PTI*

*max of 15 modules (all other modules max of 9 modules)

RMM 84TE: 10 free slots for: MVB, CAN, SIU and/or AIM*, HSA, DIO*, DRO*, AOM*, PTI*

*max of 6 modules



Compliance

- ✓ EN 50155
- ✓ EN 45545
- ✓ IEC 62443-4-2 up to SL 2
- ✓ IEEE 1482-1.1999
- ✓ IEC 62625-1
- ✓ GM/RT2472-1.2002
- ✓ EEIG 97E461-3.1998



MVB Intrusion Detection

**Secure the MVB network against
cyber intrusion. Developed in
collaboration with RazorSecure.**

Overview

The MVB network carries signals that directly affect train safety, reliability, and availability. While traditionally considered a closed and trusted network, the increasing digitalisation of train systems has introduced new cybersecurity risks. A compromised device can transmit rogue messages onto the network, potentially disrupting operations, affecting safety-critical functions, or providing a pathway to wider system compromise.

Because these attacks originate from what appears to be a legitimate device, they can be difficult to detect using conventional security measures alone. Without continuous monitoring, malicious or unexpected activity may remain unnoticed until operational disruption has already occurred.

The EKE-Trainnet® MVB Monitoring Solution with the RazorSecure Intrusion Detection System (IDS) identifies unusual network behaviour, anomalous message traffic, and suspicious device activity, enabling operators and maintenance teams to detect potential cyber threats early and take action before they affect train operations.



MVB Intrusion Detection

Key Features

Vendor Independent



The EKE-Trainnet® MVB Intrusion Detection works with any MVB regardless of the manufacturer.

Flexible Data Output



Raw or preformatted data (XML, JSON, etc.) can be exported according to customer preference, with Ethernet as the standard interface.

Total Network Visibility



Unlike conventional systems, our monitoring device collects all data traversing the MVB, not just the preconfigured streams.

Non-Intrusive Integration



The device connects to the MVB bus without interfering with the control network, ensuring operational safety and compliance.

CRA Ready



Secure-by-design in accordance with the Cyber Resilience Act (CRA), Regulation (EU) 2024/284 and IEC 62443-4-2 cybersecurity requirements up to Security Level 2.



**Developed in collaboration with
RazorSecure**

Built on 40 Years of Train Network Expertise

Built on 40 years of experience in on-board train data networks, the EKE-Trainnet® MVB Monitoring Solution provides a robust foundation for cybersecurity monitoring in train applications. The solution utilises the high-performance CPU6000 platform to support continuous network monitoring and analysis.

The solution delivers direct access to raw MVB communication, enabling independent analysis of network activity and supporting cybersecurity monitoring throughout the vehicle lifecycle. This reduces reliance on original manufacturers for cybersecurity support and helps operators maintain visibility across legacy, mixed, and evolving fleets.

Compatible with any MVB network regardless of manufacturer, the solution is based on hardware specifically designed for train environments. All hardware is type tested to EN 50155, certified to EN 45545, and compliant with RoHS and REACH requirements.

Move from Passive Monitoring to Active Cyber Threat Detection

Each solution is supported by RazorSecure's advanced IDS. Designed specifically for rail, RazorSecure's IDS leverages powerful anomaly detection to identify unusual and unexpected network behaviours, going beyond traditional IDS systems that rely solely on known threat signatures.

Delta provides comprehensive network topology visibility and the foundation for a proactive cybersecurity strategy. With deployments on over 1,000 trains globally, Delta is highly effective in detecting potential cyber threats supporting a timely and targeted response.

How does MVB Intrusion Detection Work?

1 Installation

The EKE-Trainnet® MVB Monitoring Solution is installed at a location where there is access to the MVB bus. It can be installed with any MVB regardless of the manufacturer.

2 Learn the Baseline

RazorSecure's IDS learns normal bus traffic patterns by analyzing MVB telegrams. It establishes a baseline of Process Data port and Message Data communications, including the devices involved, F-codes, telegram types, and their timing and frequency.

3 Data Collection

The EKE-Trainnet® MVB Monitoring Solution collects all data traversing the MVB, not just the preconfigured streams.

4 Data Review

Once the IDS system learns this baseline, it can detect in real time any telegram that deviates from it.

5 Alert the Operator

The system detects Message Data telegrams with unexpected F-codes or destination addresses, as well as devices or ports behaving outside normal parameters. Any anomalies are instantly flagged and reported to the operator for rapid investigation and response.

Specification



Technical Data

Minimum rack size:

158 mm × 133 mm × 215 mm

Minimum weight:

1.3 kg + module weight

Input voltage:

24–110 V DC

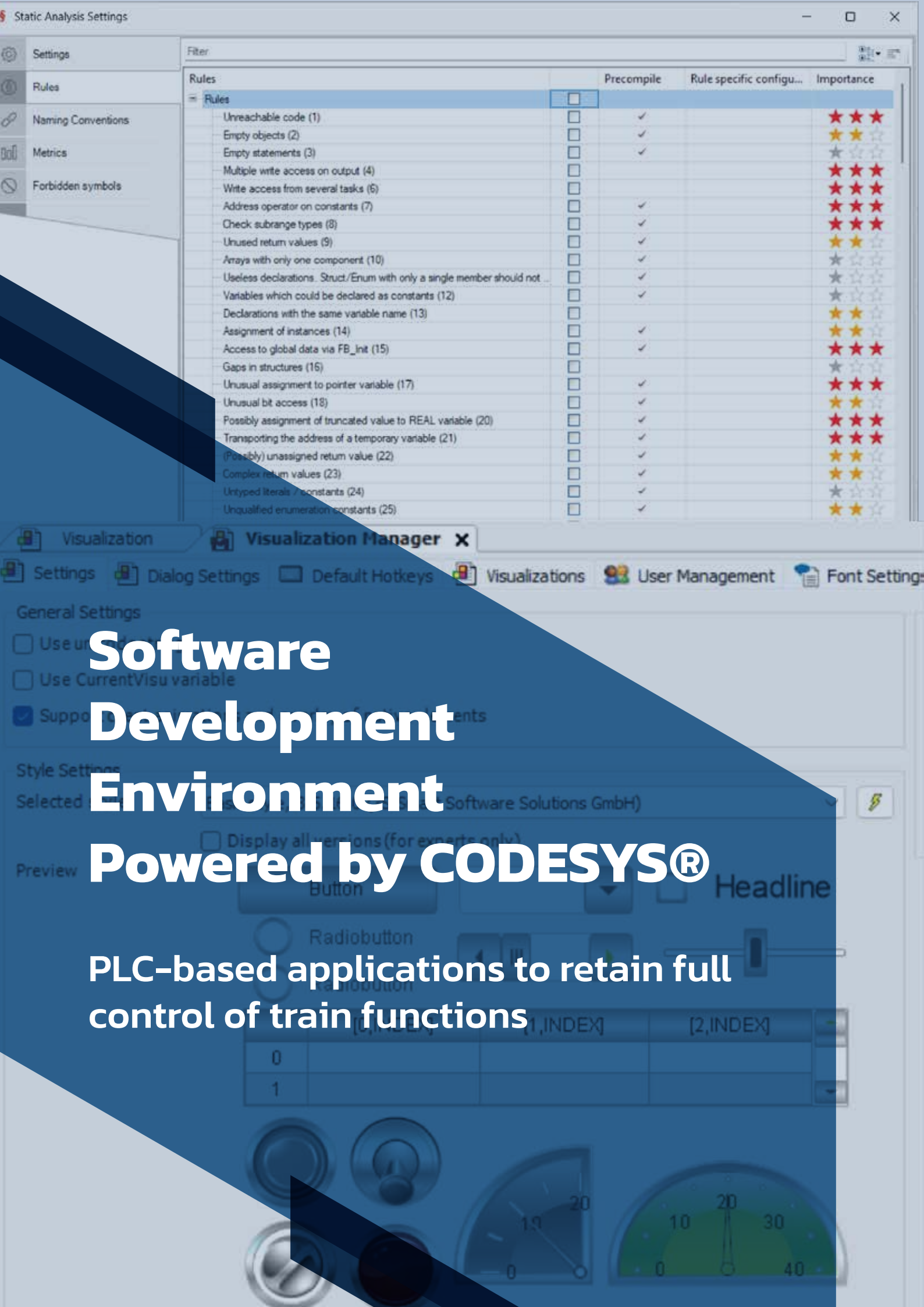
Operational temperature range:

–40 °C to +70 °C



Compliance

- ✓ Type tested according to EN 50155
- ✓ Certified to EN 45545
- ✓ Compliant with RoHS and REACH



Software Development Environment Powered by CODESYS®

PLC-based applications to retain full
control of train functions

Overview

EKE-Electronics builds TCMS applications using CODESYS® or C on top of Linux. These applications ensure train functions align with vehicle design and operational needs throughout the lifecycle. The Linux-based platform supports IEC 61131-3 (PLC), including C-based function blocks, libraries & drivers for all bus and I/O modules, and third party integration without vendor lock-in. This gives full control over system functions whilst supporting easy integration and long-term adaptability.

Developers who prefer C/C++ can use our comprehensive C libraries to build applications directly on Linux, providing maximum flexibility and full access to the platform's capabilities.

EKE-Electronics provides a flexible approach to TCMS platform development, tailored to your project requirements. Whether you choose to handle development internally or take advantage of our technical expertise, we offer the tools and support needed to ensure success. We train OEMs and integrators to build and manage software applications independently or deliver a complete, ready-to-use solution.



Key Features

Fully Compliant IEC 61131-3 Development Environment



CODESYS® provides a standard IEC 61131-3 development environment with support for all major programming languages, enabling flexible integration and long-term maintainability.

Built-In, Full-Stack Engineering Toolset



Integrated development tools, including object-oriented programming, Git source control, testing, simulation, and debugging, streamline development and validation while improving quality and maintainability.

Open Linux, Non-Proprietary Platform



CODESYS® supports C-based function blocks, custom I/O drivers, and third-party integration without vendor lock-in. This gives full control over system functions and supports easy integration and long-term adaptability.

Ready-Made Libraries



EKE developed libraries for TRDP, Ethernet, WTB/UIC 556, MVB, and other train interfaces provide ready-made building blocks, supported by optional training and expert services to accelerate development and reduce engineering effort.

Specification



Recommended PC Requirements

Operating system:

Windows 10 / 11

Recommended System Properties:

2.5 GHz Processor

8 GB RAM

12 GB available HD space

64 bit version of the operating system

Other requirements:

Ethernet port for downloading applications to EKE-Trainnet® CPUs



Compliance

- ✓ IEC 61131
- ✓ IEC 61375
- ✓ UIC 556
- ✓ IEC 62443-4-2 up to SL 2



Language Support

IEC 61131-3 (PLC)

C / C ++

Python (for non-real-time control)





Train Modernisation and Refurbishment

**Extending service life with a structured
upgrade approach**

Overview

EKE-Electronics supports train modernisation projects with a clear, system-level approach. We focus on upgrading control and communication systems while respecting the existing vehicle architecture. This allows operators and integrators to enhance performance and maintainability while managing cost, downtime, and project risk.

Our role can range from supplying individual subsystems to delivering complete train control upgrades. Each project is approached with a clear understanding of the existing system and a defined path to the required end state.

Integration of Legacy and New Systems

A key challenge in refurbishment projects is connecting older systems with newer technologies. Our TCMS platform and Gateway solutions are designed to bridge different communication protocols and system generations.

Flexible Hardware



Space and existing cabinet layouts often constrain refurbishment projects. Our modular hardware and multiple rack formats support both standard and restricted installations. This flexibility allows new control systems to be installed without major structural changes.

Supporting New Functions



Modernisation adds new capabilities without replacing existing systems. Our platform supports control updates, automation integration, improved diagnostics, and data collection, while maintaining compatibility and consistent behaviour across the train.

Cybersecurity



Cybersecurity can also be strengthened during system upgrades. All our TCMS systems are based on the high performance CPU6000 Series. These CPUs provide state-of-the-art cybersecurity features through a secure-by-design architecture and controlled access.

Lifecycle Support



EKE-Electronics provides lifecycle support for delivered systems, including spare parts, repair services, and technical assistance both remotely and on-site. We also support customer teams with training and development tools, enabling them to manage, maintain, and adapt systems independently.

Our Experience

EKE-Electronics brings four decades of experience in train automation, system integration and on-board communications. More than 1,200 coaches across multiple countries have been refurbished using EKE-Electronics' platform. Our most recent major fleet modernisation programmes were for London Underground Central and Bakerloo lines.



**TRANSPORT
FOR LONDON**



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Smarter trains. Better future.

IRIS[®]
Certification

v3.0