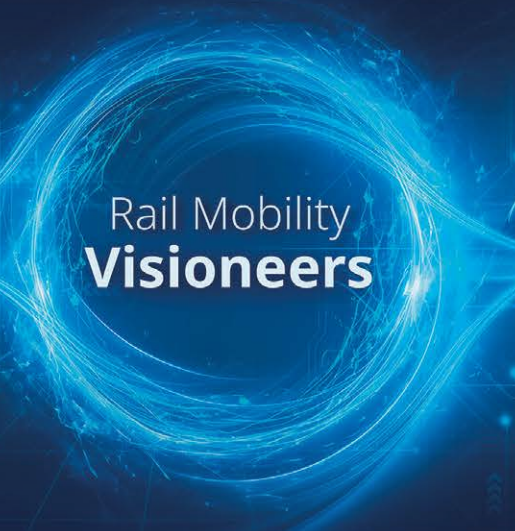


Knorr-Bremse at InnoTrans 2026



Rail Mobility
Visioneers

Solutions for the entire rail ecosystem

On-Train Solutions

Wayside Solutions

X.Sectional Solutions



KNORR-BREMSE



Contents

ON-TRAIN SOLUTIONS

- 5 _____ Future Rail Freight Transportation – our vision for the future of rail freight
- 6 _____ Brake-by-air – with our digital-pneumatic braking system
- 6 _____ Brake-by-wire – with our digital-electromechanical braking system
- 7 _____ Measurable sustainability – thanks to Sustainable Friction Pairing
- 8 _____ AirSupply Smart – the next-generation smart air supply
- 9 _____ Reliability determines availability – our next-generation toilet
- 9 _____ Flexible energy management – with our Smart Integrated Functional Unit
- 10 _____ LEADER – driver assistance and rail freight automation
- 11 _____ ZeroStepBoarding system – no-compromise comfort and safety
- 11 _____ Platform door systems with a modular design

WAYSIDE SOLUTIONS

- 13 _____ Data-driven Interlocking – with intelligent Wayside Control
- 14 _____ Field Elements – seamlessly integrated across the network
- 15 _____ Level Crossing – safe, reliable control where rail meets road

X.SECTIONAL SOLUTIONS

- 17 _____ RailServices – the independent full-service provider
- 18 _____ Computing. Control. Communication – Embedded Electronic Solutions
- 19 _____ Digital Solutions – turning raw data into valid decisions

On-Train Solutions

Products & Solutions on and in the train

WAYSIDE SOLUTIONS

X-SECTIONAL SOLUTIONS





Future Rail Freight Transportation – our vision for the future of rail freight

To transport freight by rail today, one thing is still essential: plenty of time. That's because freight trains are still coupled manually, as they were back in the 19th century – a time-consuming, labor-intensive process. As a result, single wagonload (SWL) traffic – a key component of flexible supply chains – suffers from an enormous disadvantage versus road-based competitors. Future Rail Freight Transportation describes our strategic vision for modernizing the world of rail freight through systematic automation and process digitalization.

The Digital Automatic Coupler (DAC), known at Knorr-Bremse as FreightLink, is a key enabler: As a multifunctional interface between locomotive and freight cars, as well as between the freight cars themselves, FreightLink establishes an integrated power and data connection along the entire train. This enables the automation of core functions, such as automated brake testing and remote decoupling.

Highlights include Knorr-Bremse's DAC, the new Knorr-Bremse e-coupler and, in our Deep Dive section, a demonstration showing how they interact with the automation system known as FreightControl. It includes, among other things, the Sensor Box and carrier for our KEf/KRf and KEd valves, the centralized automation and control system FreightControl Core, digital elements for our compact freight train brake TreadAct Freight, and our Power Supply Box for powering the automation equipment. We offer a complete range of solutions: wired (DAC type 5), wireless, or self-contained aboard each railcar in the form of FreightControl Sentinel. Our display screen shares insights from ongoing DAC 5 field trials and illustrates the roles played by individual automation components in the system as a whole.

Brake-by-air – with our digital-pneumatic braking system

Reliable, proven and here to stay for the foreseeable future – the pneumatic brake remains a tried and trusted backbone of international rail transportation. Compressed air is still the proven medium for generating braking force and, in some cases, for transmitting braking signals – although increasingly, pneumatic brakes are now digitally controlled and connected to other systems. We demonstrate exactly how it all works in our Evolution of Braking exhibit, taking the example of our increasingly sophisticated digital-pneumatic braking system. As usual, our demonstration focuses on the system as a whole, covering the compressed air supply, pneumatic brake control system, and related bogie equipment. Our on-screen application also explains the approach we have taken to our Virtual Validation for Certification (VV4C) solution. As a virtual platform, it simulates all the standard testing scenarios and inspections, ensuring that braking systems are fully compliant with all necessary certification requirements during the approval process.



Brake-by-wire – with our digital-electromechanical braking system

Vehicle manufacturers and operators have made their requirements for future train generations very clear. They want lighter vehicles, lower lifecycle costs, and reduced energy consumption – plus braking performance that cuts headway times, enabling more frequent train services and increasing the capacity of existing infrastructure. Our response, the digital-electromechanical braking system (EMB), is spearheading a groundbreaking transformation of braking technology that aims to satisfy precisely these requirements.

Our innovative system for mainline rail applications is based on the “brake-by-wire” principle. Both braking signal and braking force are produced





and transmitted electronically – no need to install onboard compressors, air reservoirs, or complicated pipework. The design has other advantages: Its improved braking dynamics reduce braking distances, and by not using compressed air to transmit and store energy, we obtain significant energy savings.

Our Evolution of Braking exhibit illustrates the chain of braking functions managed by individual EMB units. In our example, the brake lever from our modular Motion Controller system issues the braking command. Our intelligent Power Management System (iPMS) provides a safe, reliable energy supply. The system is controlled by the latest generation of our MAS200 control unit. And the braking force is delivered by our ElectroAct electromechanical brake caliper, combined with a proven friction pairing.

Measurable sustainability – thanks to Sustainable Friction Pairing

Which brake pads, which brake discs are the most sustainable? There's no single, simple answer. What may be suitable for a high-speed train won't work for a metro train running in urban tunnels. As a full-range supplier of friction materials manufactured in-house, we deliver application-specific friction pairings for every type of train, complying with all rail industry standards worldwide. And for each new application, we pose the same sustainability question.

Sustainable Friction Pairing is our name for this strategic approach to application-driven, measurable sustainability. It involves assessing the application against five key criteria: carbon footprint, particulate matter emissions, material compliance, circularity, and energy savings in operation. This holistic approach rethinks the friction pairing relationship in terms of future needs – we consider the rail vehicle as a complete system, taking account of its entire lifecycle, including end-of-life solutions. Decades of accumulated data, analyzed and validated in simulations and test rigs, ensure that our calculations are dependably accurate.

Our exhibit uses three brake discs made of aluminum, gray cast iron and steel to illustrate the main material considerations. Also on show: our organic brake pad, sintered brake pad, and new metro brake block. The exhibit's on-screen application explains how friction pairing, design, and operating conditions all impact the five sustainability criteria.



AirSupply Smart – the next-generation smart air supply

AirSupply Smart is the intelligent way to deliver compressed air. As a fully integrated platform with a smart control system, it delivers compressed air on demand while taking account of vehicle load and speed, track topography, and the number of braking operations. Rail operators benefit from a fundamentally new, eco-friendly approach to managing the energy consumed and the noise generated by their air supply system.

The system's flexibility is further enhanced by three operating modes: Silent Mode ensures that it runs significantly quieter when, for example, vehicles are parked overnight or standing in train stations. This optimized operating mode also improves the

compressor's service life. Boost Mode increases the air delivery rate so that smaller, lighter compressors can be used without disrupting train setup times. Panto Mode makes auxiliary compressors redundant, reducing the rail vehicle's weight, complexity, and lifecycle costs.

As well as being even easier to maintain, the combination of AirSupply Smart with ScrewSupply Eco screw-type compressors cuts lifecycle costs (compared to the previous generation) by more than 40 percent and reduces weight by 20 kg. The exhibit showcases this system together with our DrySupply Compact air dryer – more compact than ever since we shaved 20 percent off the height.



Reliability determines availability – our next-generation toilet

For passengers, sanitary facilities are among the most visible systems on a train – and of course they play a vital role in ensuring a comfortable journey. For operators, quite apart from passenger comfort, there's another aspect to consider. Sanitary systems are mission-critical components: Defective toilets can cause entire trains to be taken out of service. This is why reliability – and thus availability – was one of our top priorities when developing our Next Generation Toilet (NGT). Our NGT exhibit can be rotated to reveal its technical solutions and internal design. Also on display: our new MLC 2.0 control unit.



Our interactive screen also showcases the smart maintenance concept behind our new sanitary system: Key operational indicators such as vacuum and pressure buildup, as well as tank levels, are

monitored in real time. The collected data is then transferred to a remote condition monitoring facility, where it contributes to our condition-based maintenance service.

Flexible energy management – with Smart Integrated Functional Unit



Modern rail vehicles place high demands on control electronics. But complexity is the inevitable result of the growing need for automation and digitalization. Consequently, vehicle manufacturers face an enormous integration challenge when it comes to arranging huge numbers of individual components – energy meters, breakers, isolators, motor protection switches, and other power control components – inside the vehicle.

This is exactly where our Smart Integrated Functional Unit (SIFU) fits in. By combining numerous control and diagnostic components for power distribution in a single compact, digitalized system, SIFU can reduce cabling requirements by over 70 percent. The modular design also supports flexible adaptation to specific customer needs.

A second aspect addressed by SIFU: As environmental awareness grows, it is becoming increasingly important to measure and manage energy in vehicles. SIFU's sensor technology precisely measures the current and voltage of consumed and recovered energy, enabling operators to analyze their vehicles' energy consumption and take the appropriate steps to enhance their efficiency. New this year: Our digital on-screen application explains how our new SIFU AC variant works in alternating-current applications.

LEADER – driver assistance and rail freight automation

It takes at least 190 kilowatt-hours of electricity to accelerate a 1,800-ton freight train from standstill to 100 km/h: An enormous amount of energy, especially if the stop was avoidable – so if, for example, a slower train ahead caused the signal to turn red. In fact, it's quite possible that LEADER Flow could

have prevented the stop in the first place. That's because our advanced driver advisory system now incorporates live traffic data into the algorithm used to generate driving advice. The new algorithm processes data on the relative positions and speeds of trains ahead, using a predictive driving approach to advise train drivers and operators how to avoid unnecessary stops.

To measure the resulting energy savings, we installed the LEADER Flow app on tablets used by 25 train drivers and then analyzed data from some 400 runs. In the course of this field trial, LEADER Flow achieved average energy savings of 10.2 percent.

At the same time, we continue to develop our LEADER AutoControl train automation system for the U.S. market: Operators can choose a fuel savings or time savings driving strategy to meet operational goals. In Australia, LEADER AutoPilot has been a well-established system for fully autonomous operations for over seven years.



Josef Baier, Vice President Global Brake System:

“The On-Train Solution Area showcases the technologies that directly influence how a train operates every day. It brings together innovative solutions and intelligent functions that support reliable operation across a wide range of rail applications.”

ZeroStepBoarding system – no-compromise comfort and safety

At this year's InnoTrans, we're presenting our ZeroStepBoarding system together with our E4 double-leaf door system for regional and commuter trains. With a door threshold reduced to as little



as nine millimeters, our ZeroStepBoarding system complies with stringent European and American regulations for barrier-free boarding and alighting. It's equally suitable for use with sliding steps, gap bridges and ramp systems, and combined with our E4 door system, can provide a clear passage width of up to two meters. The entire system is further enhanced by contactless boarding, enabled by our TouchlessBoarding sensor and ProDect 2S obstacle detection system. Installed on the door's closing edge, the system acts as a complete door throughway detection solution that complies with the latest passenger safety standards. The system speeds up train departure times – and doesn't require the additional space taken up by a costly light grid. The Select door control unit is the heart of our entrance system, combining state-of-the-art cybersecurity with an extensive ecosystem of digital service solutions. Our comprehensive portfolio includes Condition Monitoring, as well as advanced maintenance applications such as our Smart Maintenance Tool, Safety Check App and new Digital Maintenance Book. Together, they support predictive, data-driven train operation – optimizing efficiency, transparency, and system uptime.

Platform door systems with a modular design

Urban travelers and commuters can choose their preferred mode of transportation. Subway and metro systems must compete with more accessible, typically overground options such as trams, buses, or taxis. With our platform door systems, we're helping to minimize the difference – because a well-designed platform is much more likely to appeal to passengers.

The systems showcased by our digital interactive exhibit physically separate platforms from train tracks, creating a controlled transition zone. Platforms become safer, cleaner, and quieter. Train dwell times become shorter and more predictable.

Needless to say, platform door systems are also among the infrastructural requirements for automatic train operation (ATO). Our portfolio includes three different systems – fully glazed, ceiling-to-floor Platform Screen Doors (PSD), half-height Platform Edge Doors (PED), and low-profile Platform Safety Gates (PSG). All are equally suitable for new-build projects and existing infrastructure.

Upon request, we can upgrade all three versions with digital features such as dynamic lighting, real-time status displays, integrated speaker systems, media screens, or Wi-Fi – as well as digital system monitoring to optimize uptime.

Wayside Solutions

Products & solutions for track and infrastructure



Data-driven Interlocking – with intelligent Wayside Control

Two factors in particular determine the safety and capacity of rail transportation: rail vehicle braking systems, and the interlocking and signaling technology on the infrastructure side. With our Wayside solutions, we bring a unique strength to this field: a deep understanding of systems in both worlds – rolling stock and infrastructure.

At the heart of our Interlocking exhibit is the ElectroLogIXS VLC (Vital Logic Controller). This scalable wayside controller covers a wide range of signaling applications, from the smallest signal repeaters to complex interlockings. The consistent platform architecture of the AREMA-compliant, CENELEC-compliant VLC enables the shared use of hardware modules and software tools across interlocking, level crossing, and other wayside signaling applications. This reduces the engineering and installation overhead, simplifies maintenance, and lowers spare parts requirements.

In addition, real-time operational data can be exchanged between the Wayside System Data Management Module (WSDMM™) and the Data Acquisition Unit (DAU). The DAU acquires the relevant operational data directly at the trackside, while the WSDMM™ handles structured data processing, storage, and analytics, as well as alarm management. As an open-edge IoT platform, the module provides specialized analytics applications for typical wayside use cases – including track circuit health monitoring, predictive maintenance of switch machines, and early detection of degrading level crossing components. Through an open data interface, customers can also develop and deploy their own analytics and business intelligence applications on the platform. The interactive screen application illustrates how the individual components of these complex systems interact in operation.



Field Elements – seamlessly integrated across the network

In our Field Elements exhibit, we demonstrate how our solutions systematically control infrastructure along the route and help operators transform their infrastructure into a connected, fully integrated system.

The ElectroLogIXS Object Controller acts as the central control unit for such projects by managing and monitoring all connected signals, switch machines, track circuits, and axle counters – thus linking physical track infrastructure with digital control logic. As part of the ElectroLogIXS platform, the Object Controller shares hardware modules and software tools with the Vital Logic Controller (VLC) and can be integrated with interlocking (centralized) or field (distributed) applications. It also supports multiple data transmission protocols. This ensures system consistency, reduces lifecycle costs, and makes the architecture scalable and future-proof. The ElectroLogIXS system can be configured

with redundant control objects, which increases operational resilience.

Also on display: LED-based signal indicators in application-specific configurations for different route types and operating environments. Our third generation of LED line signals, LED COMPACT, combines modern technology with a systematically optimized, robust, and fully recyclable IP65-certified design to deliver a long service life, reduced maintenance overhead, and low lifecycle costs. One particular advantage is the line signal's compatibility. Because its functionality and electrical interfaces with the interlocking system remain unchanged, the new generation can be seamlessly integrated into existing infrastructure without requiring fundamental modifications to established system architectures. The exhibit's interactive screen application illustrates what the system architecture delivers and which applications it enables.

Level Crossing – safe and reliable control where rail meets road

Level crossings and grade crossings rank among the most safety-critical points in rail infrastructure. Where rail, road, and sometimes pedestrian traffic converge, absolute safety is essential.

Our Level Crossing exhibit consists of a stylized crossing with barrier, LED signal indicators, and a physical control unit in the form of the ElectroLogIXS XP4 Object Controller. The latter enables the safe, reliable management and monitoring of all crossing system components and, as part of the ElectroLogIXS platform, combines our longstanding experience in level crossing control with the modern capabilities of an integrated platform architecture.

For project-specific deployment, the XP4 can be configured with dedicated modules for detecting trains and controlling warning devices – precisely



tailored to the requirements of these safety-critical applications. The redundant design ensures maximum operational resilience. The scalable architecture also ensures that the system can grow to meet future needs. The exhibit's interactive screen application illustrates how the system works in operation.



Jeff Baker, Managing Director, KB Signaling

"We now offer a comprehensive portfolio of wayside solutions. They ensure that trains are guided safely and reliably and passengers benefit from seamless railway operation."

ON-TRAIN SOLUTIONS

WAYSIDE SOLUTIONS

X.Sectional Solutions

Services for On-Train and Wayside



RailServices – the independent full-service provider

Because the demands made of rail vehicles can change multiple times in the course of service lives that usually last for decades, there is a growing need for flexible, scalable service solutions. As a manufacturer-independent full-service provider, RailServices combines the depth and breadth of a global corporation with end-to-end lifecycle management of rail vehicles and vehicle systems.

Two of the exhibits at this year's booth highlight the strengths of our RailServices portfolio: Modernization covers the full range of our lifecycle extension services, from product upgrades and connectivity enhancements through to complete modernization. Component Maintenance covers

the maintenance services we offer at component level, as illustrated by the two halves of a cutaway brake caliper: One half shows the condition it was in before the overhaul, the other its condition after the overhaul.

Together with EYYES, we are also presenting the RailEye® Front Collision Warning solution. The system uses AI and high-resolution cameras to detect obstacles and people on or near the track. In hazardous situations, it uses visual and audible alarms to alert train drivers, and can even trigger automatic braking if the driver fails to respond. In a video, we demonstrate how this works in various applications from around the world.

Computing. Control. Communication – Embedded Electronic Solutions



Most modern rail vehicles rely on mechanical and pneumatic technologies. But only electronics can make the interactions between rail vehicles and infrastructure efficient, safe, and sustainable.

Our Embedded Electronic Solutions business unit combines the expertise of two group brands: duagon and Selectron. Their joint portfolio covers the entire spectrum of electronics required by the rail ecosystem. Our Computing & Control exhibit showcases computer architectures, control and management systems, and OS tooling – from high-performance computing (HPC) through to our SIL pre-certified duagon Operating System. Our Train Control Network exhibit focuses on in-vehicle communication, from established bus technologies such as CAN and MVB to Ethernet-based switches and routers.

For a 360° deep dive into our entire portfolio, visit us in Hall 27, Booth 740.



Tomislav Radjenovic, Site Manager, Selectron:

“Our Embedded Electronic Solutions represent the joint approach taken by duagon and Selectron to building integrated, future-proof rail systems. By joining forces, we’re now able to offer our customers both bespoke, project-specific solutions and modular, ready-to-use products.”



Digital Solutions – turning raw data into valid decisions

With our Digital Solutions, we combine our expertise in rail vehicle and rail infrastructure systems with IoT, artificial intelligence (AI) and cloud computing to create advanced data-driven applications. Operating along the entire value chain, many of them can be retrofitted to existing vehicles or infrastructure.

Railnova is our modular, digital ecosystem for transforming raw telemetry data into operational decisions. Designed as a flexible portfolio, our connected suite includes Railster telematics hardware for collecting asset data in real time, Railgenius for converting this telemetry data into remote diagnostics and proactive alerts, and Railfleet for automating maintenance schedules based on actual operating hours and asset condition. Intelligent AI agents automatically categorize

error messages, giving fleet managers the clear information they need to optimize performance. Other digital use cases on display: FreightControl Sentinel for intelligent monitoring of safety-critical freight train components, as well as applications emerging from our partnership with EYES and other partners specialized in infrastructure monitoring.

Our exhibit also highlights the new level of refinement of the European Rail Data Space. In compliance with all relevant EU regulations, it ensures full data sovereignty while providing a secure, standardized framework for sharing data across system, manufacturer, and national boundaries – for applications such as the Digital Battery Passport or maintenance-optimizing digital twins.

**KNORR-BREMSE**

Braking Systems	Hall 1.2, Booth 250
Coupling Systems	Hall 1.2, Booth 250
Entrance Systems	Hall 1.2, Booth 250
Signaling Solutions	Hall 1.2, Booth 250 Hall 27, Booth 740
Embedded Electronic Solutions	Hall 1.2, Booth 250 Hall 27, Booth 740
Power & Grid Solutions	Hall 1.2, Booth 250
Sanitary Systems	Hall 1.2, Booth 250
RailServices	Hall 1.2, Booth 250 Hall 27, Booth 740



Member of Knorr-Bremse	Hall 1.2, Booth 250
------------------------	---------------------



Europe's Rail	Hall 4.2, Booth 250
---------------	---------------------



Ferrovie Dello Stato Italiane	Hall B, Booth 610 (CityCube)
-------------------------------	------------------------------

**KNORR-BREMSE**