

Edition 5

ON TRACK!

The international magazine of Lütze Transportation GmbH

Cybersecurity on the Rail

**When Two Systems Speak
the Same Language**

**High-speed Ethernet
Made Easy to Retrofit**

**Proven Rail Compatibility With Greater
Performance, Connectivity, and Comfort**

**Charging Convenience in the
Sleeping Cars of the Future**

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Cybersecurity on the rails



When Two Systems Speak the Same Language



High-speed Ethernet made easy to retrofit



Upcoming new solutions: Interview with LÜTZE TRANSPORTATION Product Management



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Dimitrios Koutrouvis
Managing Director
Lütze Transportation GmbH

EDITORIAL

Dear Readers,

When talking to vehicle manufacturers, operators and industry experts today, one thing quickly becomes clear: the rail industry is entering a period that is both exciting and challenging. The global expansion of rail transport is gaining momentum, while expectations in terms of availability, efficiency and safety continue to rise.

Digitalization in particular is transforming our industry in lasting ways. Today, sensors provide data that simply was not available just a few years ago. New analytical methods and AI are opening up opportunities to make maintenance smarter, detect failures at an early stage and operate vehicles more efficiently. At the same time, connectivity in modern rail vehicles is steadily increasing, and with it the importance of cybersecurity.

These developments are no longer a vision of the future. They are already shaping the decisions of manufacturers and operators worldwide. The question is no longer whether these technologies will arrive, but how we can integrate them into rail operations in a meaningful and secure way. At LÜTZE Transportation, we see this as a major opportunity. Together with our customers, we are working to translate innovative technologies into robust and reliable solutions for everyday use on the rails. InnoTrans 2026 is the ideal place to discuss these key topics for the future.

The articles in this issue provide insights into current developments, new technologies and solution approaches that will help shape the mobility of tomorrow.

I hope you enjoy reading this issue and look forward to meeting you in person for further exchange.

Best wishes,
Yours, Dimitrios Koutrouvis

SECURITY

CYBERSECURITY on the rails

Author: Daniel Herbst, Product Manager Control Systems, Lütze Transportation GmbH

The EU Cyber Resilience Act (CRA) sets clear security requirements for products that are connected to one another or to the internet. This also affects rail vehicle manufacturers, which are now required to consider cybersecurity an integral part of the entire product life cycle.

The CRA's primary objective is to strengthen the resilience of European infrastructure against growing cyberthreats. In this context, security features in rail vehicles are becoming increasingly important.

Protection against digital attacks

For many years, LÜTZE TRANSPORTATION has offered the LION Train Control Management System as a comprehensive solution for the centralized and decentralized processing of safe and non-safe signals up to safety integrity level SIL2. In 2024, LÜTZE introduced the new LION TRDP bus coupler in a safe version with an SDTv2 safety layer. The safe TRDP bus coupler is based on an innovative architecture featuring the powerful SITARA® controller, which enables Secure Boot. The new TRDP bus coupler is prepared for Dual

Homing, and the Linux operating system will allow security updates to be installed remotely and automatically in the future. The new TRDP bus coupler therefore provides a blueprint for implementing modern security features in rail vehicles. The following article examines how the LION Train Control Management System can make a decisive contribution to meeting the requirements of the CRA from both a safety and security perspective.

Stricter security requirements for rail vehicles

CRA was adopted in 2024 and will apply from 2027. The CRA is intended to improve the cybersecurity of products that can be connected to one another or to the internet. It covers a wide range of products, from smart home devices and industrial systems to critical infrastructure.

The Cyber Resilience Act has far-reaching implications for rail vehicle manufacturers and operators because modern trains increasingly rely on digital systems for operation, maintenance, and passenger safety. In the future, manufacturers and their suppliers will have to demonstrate that the di-

gital systems in their vehicles meet cybersecurity requirements and that their vehicles can be protected against cyber-threats. This applies to both hardware and software. Because rail vehicles have a long service life, manufacturers must ensure the cybersecurity of their systems throughout the entire life cycle, including the provision of security updates and vulnerability management.

"Safety" and "security"

In IT in general, and in railway technology in particular, the term "safety" encompasses all systems relating to functional safety, while "security" refers to IT security.

"Safety" therefore ensures that malfunctions in systems or components cannot result in hazardous conditions. Safety focuses on the reliability and integrity of data transmissions and systems in order to prevent malfunctions. The SDTv2 safety layer plays a central role by providing mechanisms for data integrity, error detection, and redundancy. One example is Vital Data Packets (VDP), which ensure that safety data is transmitted correctly and without manipulation.



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By contrast, “security” refers to protecting systems and data against malicious attacks or manipulation. Its purpose is to ensure the confidentiality, integrity, and availability of information.

Safety functions can also help meet security requirements. For example, SDTv2 safety mechanisms can be supplemented with encryption and authentication in modern railway systems to meet security requirements. Put simply, safety protects people from machines, while security protects machines from people.

The CRA concerns both safety and security because it is intended to increase the resilience of connected products against cyberattacks:

1. Security: The CRA requires products with digital elements to be secure against cyberthreats. Manufacturers must therefore minimize vulnerabilities, provide security updates, and implement protective mechanisms to prevent attacks.

2. Safety: Improved security directly contributes to safety because cyberattacks on

critical systems, such as those used in transportation or healthcare, could endanger people’s physical safety. The CRA therefore helps ensure that security vulnerabilities do not lead to potential hazards.

Scalable safety in rail vehicles

For many years, LÜTZE TRANSPORTATION has addressed safety with LION, its modular, safety-related Train Control Management System. The LION bus system is used in countless rail vehicles worldwide. LION offers a complete solution for the

centralized and decentralized processing of safe and non-safe signals. It allows safe and non-safe I/O modules to be combined in the same I/O station and enables safety functions up to SIL2 to be implemented in rail vehicles.

The technical backbone of LION is the internal, safe L-BUS² (LÜTZE Bus), which transfers all data at 4.5 Mbps between the I/O modules (devices) and the bus coupler (head). Internally, the L-Bus uses the RS485 physical interface and controls communication, addressing, and the power supply for all I/O modules. If one or more I/O modules malfunction, the head can clearly identify the fault and continue communicating with the unaffected modules.

The LION system complies with all key railway standards, including EN 50155, EN 50121-3-2, EN 50124-1, EN 61373, and EN 45545-2. LION has an IP20 degree of protection and can be used at temperatures from -40 °C to +70 °C.

New SIL2 bus coupler with TRDP fieldbus interface

For years, LION has provided flexibility through a choice of fieldbus interfaces. Three bus coupler versions with MVB or TRDP interfaces were previously available. In 2024, LÜTZE introduced a fourth bus coupler: a safe TRDP coupler with an SDTv2 safety layer.

LION bus coupler family

- LION MVB bus coupler, non-safe version
- LION MVB bus coupler, safe version, also available with SDTv2 safety layer
- LION Ethernet TRDP bus coupler, non-safe version
- NEW: LION Ethernet TRDP bus coupler, safe version with SDTv2 safety layer

SDTv2 safety layer: Real-time monitoring of data streams

The new TRDP bus coupler uses the SDTv2 safety layer (Safe Data Transmission Layer, Version 2). The SDTv2 safety layer is a specialized safety architecture developed to protect critical infrastructure in the railway industry. It is a multilayer safety solution that combines several protective mechanisms to safeguard system integrity.

A key component of the SDTv2 safety layer is the real-time monitoring and analysis of data streams using mechanisms such as checksums (CRC) to ensure integrity and sequence counters to detect lost or repeated packets.

Linux provides cybersecurity advantages

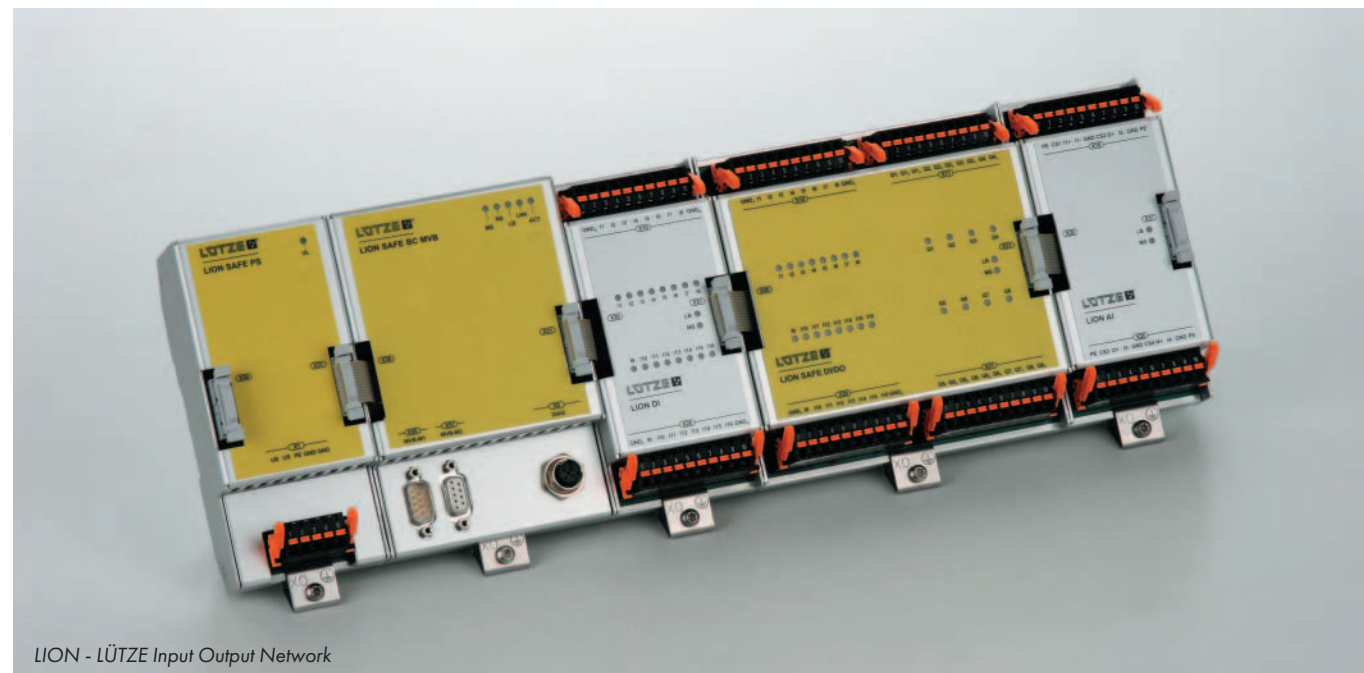
To keep the TRDP bus coupler up to date with the latest security requirements, LÜTZE TRANSPORTATION uses a Linux operating system. This enables automatic and

continuous installation of security updates. Operators can carry out automated updates so that both regular and security-related updates always remain current. These automated processes effectively minimize potential security risks. By consistently separating functional safety from IT security functions on the Linux-based SITARA® controller, necessary security updates can be installed promptly without jeopardizing the underlying SIL2 certification of the safety application. This bridges the gap between the static requirements of functional safety and the dynamic update obligations of the Cyber Resilience Act.

SITARA® controller adds Secure Boot to rail vehicle security

The new TRDP bus coupler features a new architecture based on the powerful SITARA® controller from Texas Instruments. The entire LÜTZE TRANSPORTATION family of MVB and TRDP bus couplers will gradually be converted to the new SITARA® controller architecture.

The SITARA® controller offers very high computing performance, energy efficiency, integrated security functions such as Secure Boot, connectivity, and real-time operation support. Secure Boot ensures that only authentic and unmodified software is executed on the controller. It uses a multistage verification process when the system starts. The process begins with an unchangeable root of trust in the



LION - LÜTZE Input Output Network

SECURITY

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hardware ROM. Every time the system starts, the controller checks the integrity of the boot software using digital signatures. If the signature check succeeds, the boot process continues; otherwise, it is stopped to prevent manipulation. Secure Boot is particularly important in industrial applications such as railway technology because it provides a reliable security foundation for critical control systems that must be robust against cyberattacks.

Dual Homing: Communication with two networks

The new LION TRDP bus coupler is already prepared for Dual Homing at the hardware level and will also support it at the software level in the future. This means it can communicate with different networks via two interfaces.

Dual Homing plays an important role in availability by providing additional fault tolerance. This architecture offers several advantages:

- Dual Homing ensures that if one connection or network device fails, the second connection can take over the data traffic.
- A second independent connection minimizes the risk of a single point of failure (SPOF).
- Dual Homing can distribute data traffic across two connections, potentially improving performance and preventing bottlenecks.

With the new safe TRDP bus coupler, LÜTZE TRANSPORTATION demonstrates the modern cybersecurity solutions that can



be implemented in today's Train Control Management Systems.

The use of the SDTv2 safety layer, a Linux-based operating system, Dual Homing, and Secure Boot achieves an exceptionally high level of protection that covers both safety and security and can meet the requirements of the EU Cyber Resilience Act.

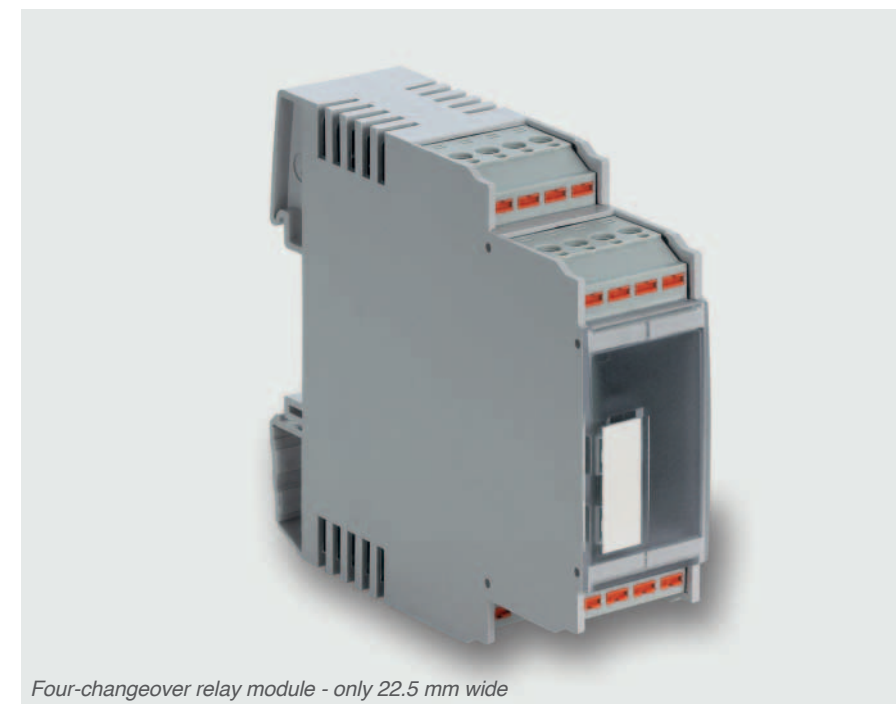
4

Compact four-change-over relay module for railway applications

LÜTZE is expanding its proven portfolio of single and double contact changeover relay modules for railway applications with a new four-changeover relay module with a width of only 22.5 mm.

With a width of only 22.5 millimeters, the new four-changeover relay module offers an extremely space-saving alternative to significantly larger and heavier contactors. The mo-

dule features two separate coil inputs with different switching thresholds: input A1.2 activates from 13 volts and is designed for 24 V and 36 V on-board power systems, while input A1.1 switches from 33 V, ensuring reliable operation in 72 V and 110 V systems. This clear separation prevents false triggering caused by residual voltages, which can occur with wide voltage range inputs. Another benefit lies in the relay being permanently soldered onto the PCB. Unlike plug-in solutions, this design eliminates contact problems caused by micro-vibrations (fretting corrosion) and reliably prevents both high contact resistance and the resulting overheating risks.



Four-changeover relay module - only 22.5 mm wide

The hard gold-plated contacts of the four-changeover relay module ensure reliable and precise switching, even at very low loads. Unlike plug-in versions, the module comes delivered fully assembled and ready to install under a single part number, significantly reducing installation and storage costs. All relevant railway standards are fully met, including EN 50155, EN 50121-3-2, EN 50124-1, EN 61373, the fire safety standard EN 45545-2, and the EMC directive 06 from the German Federal Railway Authority.

A Gateway Between Two Systems

WHEN TWO SYSTEMS SPEAK THE SAME LANGUAGE

Authors: Timo Mathä, Field Application Engineer and Daniel Herbst, Product Manager Control Systems, Lütze Transportation GmbH



Representative image of Metro, ISTOCKPHOTO

During the modernization of vehicles in South America, the DIOLINE PLC from LÜTZE TRANSPORTATION is connecting an existing RS232 system with a modern MVB-based Train Control and Management System. Acting as a Gateway, the compact controller translates data in both directions, reliably aligning the legacy and modern technology.

Modernizing existing rail vehicles is often more economical and resource-efficient than purchasing an entirely new fleet. However, a retrofit is more than just replacing individual components. As soon as proven technology meets modern control and communication systems, two generations of components have to work together - even though they do not always speak the same technical language.

This was exactly the challenge facing a operator in South America. As part of a vehicle modernization project, an existing system should be equipped with a new Train Control and Management System, or TCMS. While the older system transmitted its data serially via RS232, the modern TCMS communicates via the Multifunction

Vehicle Bus, or MVB, which is widely established in modern rail vehicles.

It quickly became clear that a common basis for communication had to be established first in order for smooth cooperation.

A Gateway Between Two Systems

RS232 and MVB differ not only in terms of their physical interfaces. Data structures, transmission mechanisms, and timing for processing information also follow different rules. Therefore, a direct connection is not possible.

The DIOLINE PLC from LÜTZE TRANSPORTATION took on this task. The compact, freely programmable controller will be installed as a communication gateway between the existing system and the new TCMS. In close coordination with the customer, LÜTZE TRANSPORTATION developed a project-specific application precisely tailored to the requirements of the existing vehicle architecture and the new TCMS environment. It receives the RS232 communication data, processes and translates it, and then makes it available via MVB. Communication works the same way in the

opposite direction: information from the modern vehicle bus is processed by the DIOLINE PLC for the legacy system.

In this way, the DIOLINE PLC does not merely translate individual words; figuratively speaking, it translates complete technical sentences. In the project, the RS-232 interface was used to transmit information including the current and permitted speed, the current vehicle position, track circuits, and various status and diagnostic data from the train control and automatic operation system. Rather than simply making this data available via MVB, the controller specifically prepares it for further processing in the TCMS. Telegrams are analyzed, individual pieces of information are extracted from the data streams, values are converted, and the data is transferred into the structure required by the target system.

In addition, the DIOLINE PLC also performs logical processing tasks. Certain information is buffered so that not only current states, but also previously received states can be made available when required. For example, the system processes the currently detected track circuit while also

TIMING IS EVERYTHING

A GATEWAY BETWEEN TWO SYSTEMS

storing the previously received value. This makes it possible to track changes in status and pass them on to the TCMS.

The gateway function is by no means limited to the combination of RS232 and MVB. Depending on the device version and project requirements, the DIOLINE PLC supports numerous additional interfaces and protocols. These include RS485, CAN2.0 (J1939), CANopen, as well as Ethernet communication via TRDP, UDP, or TCP. Local digital inputs and outputs and expansion via the LÜTZE L-Bus provide additional options for signal processing. This makes it possible to implement a wide range of combinations whenever different technical environments need to be integrated as part of a retrofit.

This project is a clear example of the contribution intelligent gateway solutions can make to the modernization of rail vehicles. Existing systems do not necessarily have to be replaced; with the right communication and control technology, they can continue to be reliably integrated into modern vehicle architectures. This helps protect existing investments while enabling the benefits of modern Train Control Systems to be fully utilized.

Fast Support Across the Atlantic

During commissioning, it became clear how important fast and knowledgeable on-site support is, in addition to the right hardware. After data transmission difficulties arose during the project, LÜTZE TRANSPORTATION responded in less than a week. Despite the considerable distance between Europe and the project site, a Field Application Engineer from the Train Control Systems team traveled to South America on short notice.



Field Application Engineer Timo Mathä

Over the course of four days, the communication paths were systematically reviewed on site together with the project team. The individual transmission steps were tested, measured values were analyzed, and the DIOLINE PLC settings were gradually adapted to the actual behavior of the systems involved.

Initially, the situation appeared contradictory: both RS232 communication and data transmission via the MVB bus worked perfectly under laboratory conditions. In the actual real-world system, however, unexpected problems occurred when sending and receiving data. Although both communication paths worked reliably on their own malfunctions occurred when the components interacted, requiring a detailed analysis of the system integration.

Timing Is Everything

At the beginning of the analysis, the entire communication chain was systematically examined, from the physical connection and data transmission through to the processing of the telegrams. This demonstrated how important it is to precisely coordinate all components for the specific application.

By verifying each section of the communication path step by step, potential sources of error could be ruled out and the actual cause could be narrowed down in a targeted manner.

The detailed analysis showed that the communication issues were not caused by the data transfer between RS232 and MVB itself. Both interfaces were operating reliably in principle. Instead, the main source of the problem was in the RS232 communication, specifically in the timing of the incoming data processing by the DIOLINE PLC.

Originally, a significantly longer transmission interval had been assumed for the serial data. However, the data bytes arrived at the DIOLINE PLC at much shorter intervals than expected. Because of this incorrect assumption, the controller's processing cycles were not optimally aligned with the actual data traffic.

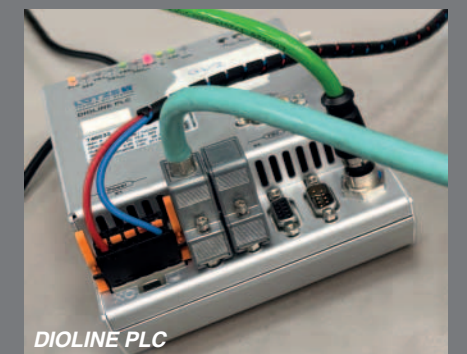
As a result, individual bytes could not always be processed continuously and completely. Some telegrams were therefore interpreted incompletely or incorrectly. Consequently, the DIOLINE PLC did not always have all the information required to correctly

convert the received RS232 data into MVB telegrams. This led to information loss and communication errors on the MVB side.

By adjusting the cycle times and the processing of the serial input data, the DIOLINE PLC could be precisely matched to the actual communication behavior. After optimization, all data was captured completely, interpreted correctly, and reliably transferred into MVB telegrams.

Step by Step Toward a Stable Connection

On-site commissioning followed a clear principle: test, evaluate, adjust, and test again. This made it possible to examine the



DIOLINE PLC

Solution Deployed, Project Back on Track

WHEN TWO SYSTEMS SPEAK THE SAME LANGUAGE

individual communication sections separately and then verify them as a complete system. The flexibility of the DIOLINE PLC was a key factor. Because the data processing is freely programmable, the required changes could be implemented without replacing the existing vehicle technology or fundamentally redesigning the system architecture.

This is precisely one of the key advantages

of retrofit projects. Existing and fully functioning equipment can stay in the vehicle while the DIOLINE PLC establishes the connection to a modern control platform. Conversion effort is reduced, existing investments are protected, and fleet modernization can be implemented more quickly.

In addition, the controller does more than simply convert protocols. Data can be checked, buffered, adapted, and prepared for

diagnostic purposes. As a result, the DIOLINE PLC performs significantly more functions within the vehicle communication system than a conventional gateway.

Solution Deployed, Project Back on Track

After the settings were adjusted, the two communication systems were successfully synchronized. Data transmission between

the existing RS232 system and the modern MVB-based TCMS operated reliably in both directions. This created the necessary conditions for the successful completion of the retrofit project.

The operator was also very satisfied with the extremely fast response, the on-site support, and the final result. Particularly convincing was the fact that LÜTZE TRANSPORTATION not only supplied a suitable component but also supported the application all the way through to a fully functional solution.

Next-Generation Retrofit Solutions

Applications such as integrating existing

systems into modern vehicle networks will continue to play an important role in retrofit projects. For these tasks, LÜTZE TRANSPORTATION already has the next generation of controllers in the pipeline. The new LION PLC family will transfer the proven gateway and control functions of the DIOLINE PLC to a more powerful platform while opening up additional possibilities for integrating different communication environments.

The product family includes a range of variants for a wide variety of application requirements, from the LION BC bus coupler and the compact LION PLC Lite to the

high-performance LION PLC Plus. The LION PLC Plus supports communication via multiple fieldbus systems and enables technologies such as MVB, TRDP, CANopen, and CAN 2.0 to be connected within a single system. This makes it particularly well suited for demanding retrofit projects in which existing and modern vehicle generations need to communicate reliably with one another.

In this way, future modernization projects can be implemented even more flexibly, existing investments can be protected, and new vehicle technology can be integrated efficiently.



LION PLC

POWER

USB-C Power Delivery in the Driver's Cab

LÜTZE TRANSPORTATION introduces a 60 W charging system with Power Delivery 3.2 technology for the driver's cab consisting of a DC/DC converter with a wide input voltage range from DC 24 V to DC 110 V and a charging cable with a USB-C port.

The new USB-C charging system from LÜTZE TRANSPORTATION is dimensionally compatible with the proven USB charging system with two USB-A ports and can therefore be easily replaced. Thanks to the wide input voltage range from DC 24 V to DC 110 V, the system can be used in both diesel and electric rail vehicles. The output provides between 5 V and 20 V at a max of 5 A for fixed Power Delivery outputs. In PPS-mode, the output delivers between 5 V and 11 V at a max of 5 A and between 5 V and 21 V at a max of 3 A. AVS supports the device between 9 V and 20



60 W USB-C PD charging system for driver's cab applications with DC/DC converter (DC 24–110 V) and USB-C charging cable

V at 3 A. Power Delivery 3.2 (PD) ensures safe high-speed charging without damaging the battery.

The new USB-C system is designed for installation in the driver's cab or in compact control cabinets and complies with the relevant railway standards EN 50155, EN 50121-3-2, EN 61373 and EN 45545-2, as well as EMC Standard 06 of the German Federal Railway Authority (EBA). This enables easy retrofitting.

The USB-C charging system offers a significant performance increase of 60 W compared to the USB charging system with two USB-A ports. This now allows power-intensive laptops and tablets to be used efficiently for conveniently updating driving data such as route maps, timetables and speed restrictions.

Both the DC/DC converter and the charging cable are dimensionally compatible with the existing USB-A system. Operators can therefore easily upgrade to the new USB-C system by simply replacing the converter, without having to modify the input wiring. No additional installation space is required, and the charging cable can be replaced 1:1 (or directly). The converter is mounted on TS35-15 or TS35-7.5 DIN rails (EN 60715).

The USB-C charging system can operate continuously in temperatures ranging from -40 °C to +70 °C. The DC/DC converter provides reverse polarity and overvoltage protection on the input side, as well as short-circuit and overload protection on the output side. The output voltage is indicated via a green LED.

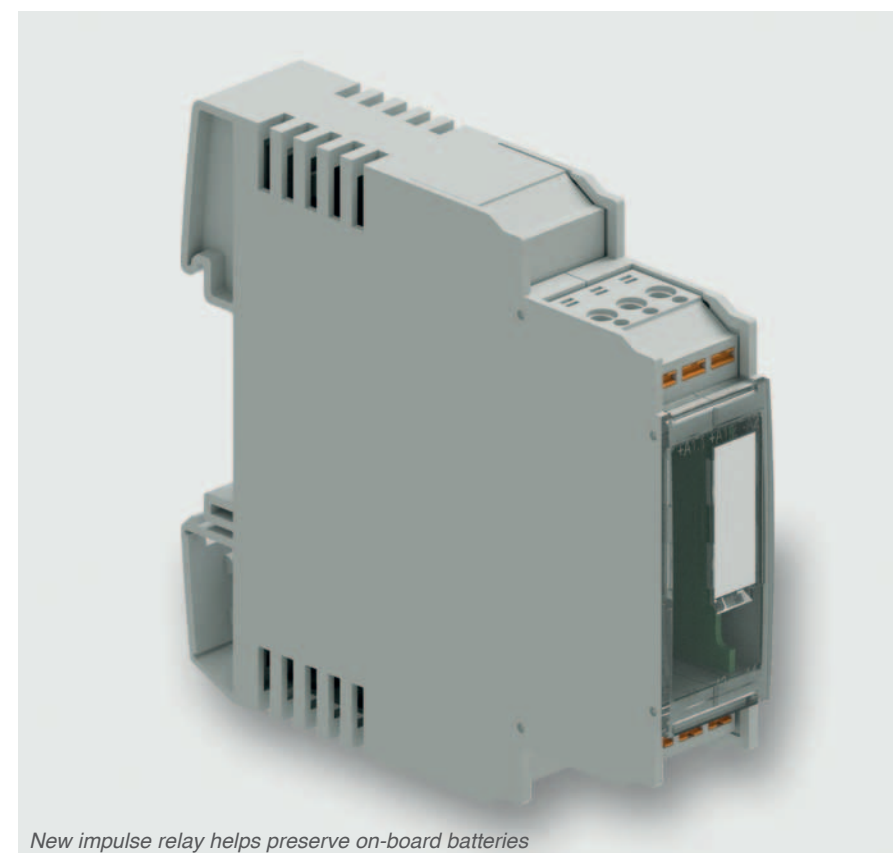
The USB-C port is designed for up to 10,000 insertion cycles. The charging cable is available in 2-meter and 0.5-meter lengths. Thanks to the optimized conductor cross-section, voltage drop is minimized. The converter automatically regulates the output to ensure that the correct voltage is always available.

In addition to the new 60 W USB-C charging system, the proven USB-A charging system with two output channels at 5 V DC and 2.1 A remains available.

NEW

NEW IMPULSE RELAY

protects on-board batteries in rail vehicles



New impulse relay helps preserve on-board batteries

LÜTZE TRANSPORTATION has expanded its range of impulse relays with a new variant that retains its last switching state without requiring a continuous supply of power. This significantly eases the load on on-board batteries in rail vehicles, especially when the vehicles are parked.

Unlike conventional impulse or bistable relays, which require a constant supply voltage, the new module stores its last switching state mechanically. A brief 100-millisecond control pulse is all it takes to switch the relay, and the selected state remains active even after the on-board power is turned off. This greatly reduces idle power consumption in parked vehicles, easing the burden on both the batteries and the overall energy management system. The new impulse relay features a wide input voltage range from DC 24 to 110 V, making it compatible with all standard on-board voltages in rail applications. The 17.5 mm wide module also includes an automatic power cut-off if the control voltage remains on for too long. If a signal is applied for more than 600 ms, the power supply is automatically interrupted to save energy. The unit has two separate control inputs with different switching thresholds: input A1.2 activates from 13 V for 24 V and 36 V systems, while input A1.1 is designed to switch from 33 V for 72 V and 110 V systems. All relevant railway standards are met, including EN 50155, EN 50121-3-2, EN 50124-1, EN 61373, the fire safety standard EN 45545-2, and the German Federal Railway Authority's EMC directive 06.

Background – Impulse relays in railway applications

Impulse relays are commonly used in rail applications for functions like extending and retracting external mirrors or controlling interior lighting. The driver presses a button: one pulse is enough to fold out the mirrors or switch on the lights; a second pulse folds them back in or switches the lights off.

However, a drawback of conventional impulse relays is that they must remain permanently connected to a power supply. If multiple relays are active in a parked vehicle, they can place a significant load on the on-board battery and strain the vehicle's energy management system.

HIGH-SPEED ETHERNET

made easy to retrofit

Author: Leszek Szewczyk, sales engineer Lütze Transportation GmbH

In public transport in the German Ruhr area, an operator is replacing the on-board computers of its active trams and light rail vehicles. As part of this, LÜTZE TRANSPORTATION is contributing a customized solution that enables data transmission over existing lines across couplings in a straightforward way.

Running on rails in the central Ruhr region is the Bochum-Gelsenkirchener Straßenbahnen Aktiengesellschaft (BOGESTRA). BOGESTRA vehicles operate in Bochum, Gelsenkirchen, Hattingen, Herne and Witten. On the Campuslinie U35, BOGESTRA's light rail line, 37 vehicles of the B80 and Tango types run on standard gauge. For the tram lines, you hop onto one of the 95 Stadler-built Variobahns running on meter gauge. These even earned a Design Award when the manufacturer was commissioned by BOGESTRA.

Good design is timeless – sadly, IT is not. The originally installed on-board compu-

ters are reaching their performance limits, which is why all vehicles are gradually being upgraded with new ones. These new computers, now standardized for both trains and buses, allow the analogue IBIS vehicle bus to be replaced with IBIS IP for almost all components. The previous 50 Mb limit for courier data storage can now be easily expanded with a micro SD card. And a SIM card in the new on-board computer renders externally operated Wi-Fi structures obsolete when it comes to processing and forwarding data – the mobile network now powers the on-board systems. That's just the start of what's planned with the new computer.



Bochum-Gelsenkirchen Variobahns operated by BOGESTRA (Image: BOGESTRA)

HIGH-SPEED

Always full bandwidth with TLM-10



Train Line Modems TLM-X and TLM-10 enable gigabit Ethernet across existing lines throughout the train via the coupling

TLM-10 joins the ride

To transmit data over existing lines via couplings, the Train Line Modem 10 (TLM-10) from LÜTZE TRANSPORTATION is used. With a transfer rate of up to 950 Mbit/sec, this solution is practically unrivalled. All passenger information data is to be transmitted – including text for internal and external displays, announcements, and driver announcements.

In the first phase, BOGESTRA and engineers from LÜTZE measured how smoothly data was exchanged between on-board computers using installed samples on site.

“Trouble-free transmission” confirmed For the standard gauge Tango vehicles with just one head-to-head transition, there was barely any loss. And in the multi-section meter gauge Variobahns, data still flowed sufficiently well despite seven connectors.

According to Sebastian Röska, the responsible BOGESTRA employee, “The TLM-10 definitely transmits the data without any issues: with our standard gauge vehicles at nearly 1 Gbit, to be precise 900 Mbit/s.” In the meter gauge vehicles, the transmission of text data is somewhat lower, but still more than sufficient – even over longer

distances. “A simple solution for using existing lines without touching the coupling,” he confirms. The retrofit project is now progressing as planned.

Always full bandwidth with TLM-10

Secure gigabit Ethernet data across an entire train via the coupling – that’s what LÜTZE TRANSPORTATION makes possible with the Train Line Modem TLM-10. It’s suitable for new builds and for retrofitting older rail vehicles with outdated cabling. Connecting to the existing vehicle wiring is enough. The TLM-10 automatically searches for the matching partner and establishes a 128-bit encrypted connection between them. This works even if the existing wiring is already being used for low-frequency applications. To ensure optimal data throughput even in the presence of external interference, the TLM-10 monitors everything using a digital signal processor (DSP). Similar to the powerline principle used in private households, it operates based on the G.HN carrier frequency method.

Camera, mobile network, Wi-Fi – it’s all possible

The TLM-10 is used at BOGESTRA for passenger information. In other applications, the modem also proves its worth for Wi-Fi, video surveillance, GPS and mobile network applications, and the seat reservation

system. Even multiple retrofitted analogue voice connections, such as driver announcements via the coupling, are possible. Here, the analogue voice data is processed before transmission and then reconverted accordingly.

Worldwide, in all rail networks

With a wide voltage input from DC 24 V

to 110 V, the TLM-10 can be used worldwide in all rail networks. It is 100% rail-compliant and meets all standards for vibration and shock loads, EMC safety, and fire behavior.

Continuous operation is possible from -40 °C to +70 °C. Installation is also straightforward: either with a flange or in a 19-inch rack.

TLM-X

The TLM-X offers a robust transmission method that is ideal for retrofit projects with older, unshielded cabling. It provides a stable high-speed Ethernet connection of up to 860 Mbps between train sections, particularly in EMC-prone environments. In contrast, the TLM-10 uses a transmission method that shows its strengths in higher quality infrastructure.



Workshop of the Bochum tram depot (Engelsburg) (Image: BOGESTRA)

“We combine proven rail compatibility with greater performance, connectivity, and comfort.”



F.l.t.r.: Yima Zimmermann, Daniel Herbst, Andreas Schindler

Interview with LÜTZE TRANSPORTATION Product Management about upcoming new solutions and greater passenger comfort. ON TRACK! spoke with Andreas Schindler (Product Manager Interface), Daniel Herbst (Product Manager Control Systems), and Yima Zimmermann (Product Manager Indication and USB Charging Solutions).

ON TRACK!: Mr. Schindler, LÜTZE TRANSPORTATION is working on several new solutions for the rail market. What is the common idea behind these developments?

Andreas Schindler: We see in many projects that vehicles need to become more compact, more connected, and at the same time more comfortable. This is exactly

where our new products come in: They are designed to save space, reduce engineering effort, provide greater comfort for passengers and staff, and at the same time meet the specific requirements of the rail environment. Our goal is not to look at individual components in isolation, but to develop solutions that integrate seamlessly into modern vehicle architectures.

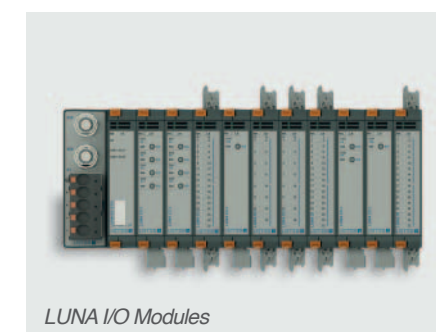
ON TRACK!: Let's start with the USB Charging Solutions. With Flex Charge, LÜTZE TRANSPORTATION is presenting a solution focused on passenger comfort. What is behind it, Mr. Zimmermann?

Yima Zimmermann: Flex Charge expands our USB charging solutions with an inductive, magnetic charging option. It is about charging mobile devices quickly, safely, and conveniently without passengers having to search for a cable. The mobile device is placed on the charging pad and automatically finds the correct position thanks to the magnetic holder. This keeps it securely in place and allows it to charge, for example, while being used as a display. Flexible integration is particularly exciting: Flex Charge can be installed, for example, in interior wall panels, tables, or on the back of the front seat. Thanks to its low-profile design, the solution integrates very well into modern interior concepts. Initial prototypes can be seen on the ALISA trains during InnoTrans.

“Flex Charge makes charging mobile devices on trains easier, safer, and more intuitive.”

ON TRACK!: In the Control Systems area, the LUNA family is being expanded. What role do the new LUNA I/O Modules play?

Daniel Herbst: The attractively priced LUNA I/O Modules are an important step in making the LUNA product family even more versatile. In the future, they will com-



LUNA I/O Modules

plement the existing bus couplers and CCI modules and provide additional options for connecting and processing field signals. The first models are digital modules such as DI32_24V, DO32_24V, and DO16_110V. Additional models are planned. For our customers, the combination of compact design and high channel density is especially attractive: Up to 32 inputs or outputs make it possible to acquire or control a large number of signals in a small space. This saves space in the control cabinet and can also help reduce system costs.

ON TRACK!: In the signaling area, LUCI Rail is another new solution. It is planned to be available as a LION module in the future. Mr. Zimmermann, can you tell us anything about it yet?

Yima Zimmermann: LUCI Rail is a topic we deliberately do not want to go into too much detail about yet. Specifically, however, it concerns the next generation of the lamp control unit. We are consistently developing our LION portfolio further and looking at how existing functions can become even more powerful, compact, and easier to integrate. For our customers, it is important that new component generations are not only more advanced technically but also fit existing vehicle and system concepts. That is exactly the objective we are pursuing.



LUCI Rail

ON TRACK!: Let's move on to interface technology. What is planned for LUNA 110V, Mr. Schindler?

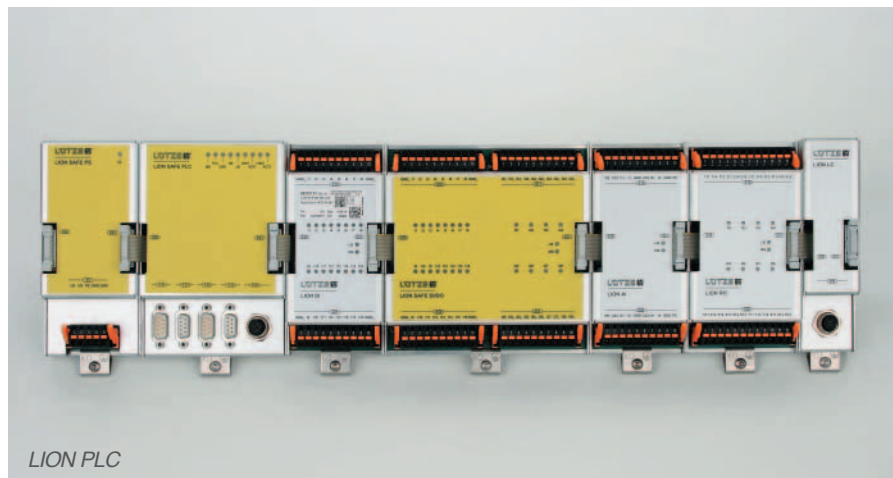
Andreas Schindler: With LUNA 110V, we are expanding the LUNA Current Control Module family for intelligent current monitoring with versions for 110 V DC. This

“Our solutions are designed to make modern rail vehicles more efficient, more comfortable, and more future-proof.”

makes the benefits of the LUNA system available for metros and other electric railcars as well. Compact design, space efficiency, and flexible installation options are particularly important in these applications. One advantage is remote control via the fieldbus connection. This allows the modules to be installed even in hard-to-access locations. Different versions are planned, including a single-channel module rated at 16 A, a two-channel module rated at 6 A per channel, and a four-channel module rated at 2 A per channel.

ON TRACK!: The new LION PLC is also being announced in the Control Systems area. What makes this control platform interesting?

Daniel Herbst: The LION PLCs, programmed with the Neuron Power Engineer, are available in three variants: PLC LITE, PLC, and PLC PLUS, depending on the number of fieldbuses and software scope. They expand the LION product family with a powerful, compact control platform and are suitable for many applications, such as gateways, subsystem controllers, or central control units.



LION PLC

Communication capability is a key point: LION PLC supports interfaces established in the rail market, including MVB, TRDP, and CAN 2.0. Combined with the modular LION I/O modules, the controller can be flexibly adapted to different applications. Cybersecurity also plays a central role. The platform is being developed according to the “Security by Design” principle and aligned with the requirements of the Cyber Resilience Act. Safe and non-safe variants are planned, allowing both safety-critical and conventional automation applications to be addressed.

ON TRACK!: For future products, hardware is not the only factor. In Control Systems, there is also talk about the LION Safe CCU with NPE. What does this mean for users?

Daniel Herbst: LION Safe CCU with NPE represents the further development of our engineering tools. NPE stands for Neuron Power Engineer. It is a modern development environment intended to provide a standardized, future-proof platform for control applications. Following its introduction in the LION microPLC, the LION

SafeCCU is also planned to be based on NPE. For users, this means an intuitive user interface, powerful diagnostics and debugging functions, and support for programming in accordance with IEC 61131-3. A planned migration tool is particularly interesting, as it is intended to simplify the transition of existing applications to the new environment. In the future, this means separate programming environments will no longer be required for safe and non-safe applications. The goal is to make engineering simpler, more consistent, and more efficient.



LION SAFE CCU with new engineering tool

ON TRACK!: Let's return to the USB Charging Solutions. The 2xUSB-C Cube 120W PD sounds like a practical solution for everyday use in a vehicle. Where do you see it being used?



USB-C Cube DC

Yima Zimmermann: The 2xUSB-C Cube 120W PD is primarily intended for DC applications, for example in driver's desks, streetcars, or metros. With it, we are presenting a more powerful DC solution that can charge mobile devices fast even during short trips. It is planned to deliver a total output of 120 W at a nominal input

voltage of DC 24 V. Despite this power, the design remains compact: as with the AC solution, the size is limited to 45 mm. This allows the cube to be used even in confined installation spaces. The ports are touch-safe due to the low output voltage, and the simple click-in installation also provides theft protection.

“Our solutions are designed to make modern rail vehicles more efficient, more comfortable, and more future-proof.”

ON TRACK!: AC solid-state switches are also part of interface technology. What advantages do these modules offer?

Andreas Schindler: With the AC solid-state switches, we are expanding our portfolio of solid-state relay modules with high-performance versions for AC loads. These new versions are intended especially for heating, ventilation, and air conditioning (HVAC) applications. The key advantage is wear-free and silent switching, even under demanding operating conditions. Initially, versions with a DC 24 V control

F U T U R E - P R O O F

"Designed to help
our customers"

C O M F O R T A B L E

voltage are planned, including a single-phase version for AC 230 V and 10 A and a three-phase version for AC 600 V and 20 A. The modules are planned to be suitable for both screw mounting and DIN rail mounting, providing flexibility during integration.



Solid-State Switches

ON TRACK!: Finally, one more product from Charging Solutions: What does the DC/DC converter 2x C PD offer for the driver's cab?

Yima Zimmermann: The DC/DC converter 2x C PD expands our family of

DC/DC converters with USB-C and Power Delivery for the driver's cab. The new feature is that two ports will be available instead of one USB-C port. Total output remains 60 W and is distributed according to the needs of the connected devices. This means, for example, that a tablet can be charged simultaneously with a smartphone, and a laptop is also generally possible. As with the previous model, the input voltage is designed for DC 24 to 110 V. Power Delivery 3.2 is also planned. This provides a practical solution for workplaces where mobile devices have been standard equipment for a long time.

ON TRACK!: If you summarize all these developments, what can LÜTZE TRANSPORTATION customers look forward to?

Yima Zimmermann: A portfolio consistently geared toward the future. We combine proven LÜTZE strengths such as rail compatibility, compact design, and reliable operation with new requirements: greater performance, greater connectivity, greater comfort, and simpler engineering. Some products are aimed more at the passenger area, while others focus on control,

interface, or power distribution. What they all have in common is that they are designed to help our customers make modern rail vehicles more efficient, more comfortable, and more future-proof. That is exactly what we are working on.



DC/DC Converter

E F F I C I E N T

SPACE-SAVING

Exceptionally space-saving signal converters for rail applications

LÜTZE TRANSPORTATION is introducing a multi-range analog converter, the first product in the new LCIS Rail housing. Optimized for rail applications, the housing complies with all relevant standards and, at only 6.2 mm wide and 68 mm deep, provides an exceptionally space-saving solution for interface technology in rail vehicles.



Multi-range analog converter in the LCIS Rail housing, only 6.2 mm wide.

With the LCIS Rail housing, LÜTZE TRANSPORTATION offers a platform for compact interface technology that is optimized for rail applications and complies with all relevant standards. Its optimized width and installation depth create more space in densely populated control cabinets. Innovative push-in connection technology supports fast, tool-free wiring, while the 2 mm test opening simplifies measurements and functional tests during commissioning and service. Insulated jumper combs are available as accessories and enable efficient potential distribution.

The multi-range analog converter reliably converts standard analog signals between controller, sensor, and actuator levels. Input and output ranges of 0–10 V, 0–20 mA, and 4–20 mA can each be set using DIP switches. This allows one device to be used for different signal tasks, reducing the number of variants, inventory requirements, and installation effort. The unit is supplied with DC 24 V. Three-way galvanic isolation rated at 1.5 kVrms ensures reliable separation of the input, output, and power supply and helps maintain the availability of sensitive signal paths.

The converter is designed for an operating temperature range of -40 °C to +70 °C. With surge protection, a PTC fuse at the current input, a short-circuit-proof output, and an accuracy of 0.1% FSR, it meets key requirements for robust rail components. Relevant standards and specifications, including EN 50155, EN 50121-3-2, EN 50124-1, EN 61373, EN 45545-2, and EBA regulation EMC 06, are fulfilled.

The product family in the LCIS Rail housing will be expanded gradually to include additional functions, including relay and solid-state relay modules.

ALISA *LÜTZE BRINGS CHARGING CONVENIENCE TO THE SLEEPING CARS OF THE FUTURE*

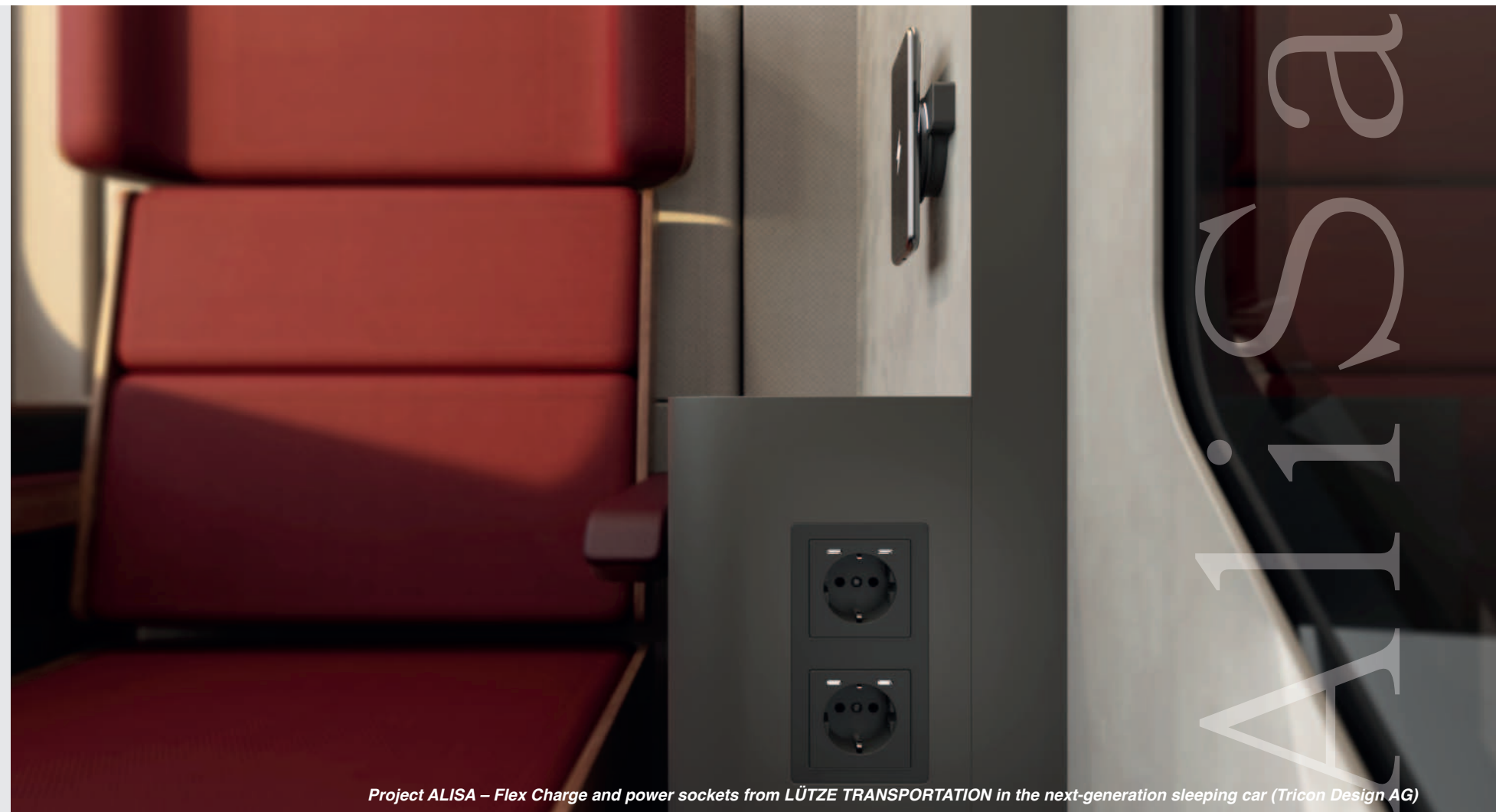
Author: Yima Leon Zimmermann, Product Manager Indication, LÜTZE Transportation

Night trains are experiencing a renaissance in Europe. But to become more than a nostalgic alternative to air travel, they must be economically viable, flexible, and comfortable. This is precisely where the AliSa re-search project comes in. The "lightweight and innovative sleeping car concept with differentiated service levels" explores what the next generation of sleeping cars should look like - from a modular carbody and passenger-centered cabins to structures optimized for lightweight construction.

The focus is on a vehicle concept that supports both daytime and nighttime operation. Compartments are designed to convert quickly from seating to sleeping areas, accommodate different comfort levels, while providing privacy, accessibility, and a pleasant atmosphere. At the same time, weight, energy consumption, and operating costs must be kept under control. AliSa therefore combines design, structural development, and technical features into an integrated approach.

The quality of modern rail travel

LÜTZE TRANSPORTATION brings its expertise with robust, rail-compatible interfaces for passenger areas to this environment. The quality of modern rail travel depends on more than just seats, beds, and lighting ambiance. It also depends on whether passengers can reliably use their digital devices at their seats, in the cabin, while working, enjoying entertainment, or resting.



Project ALISA – Flex Charge and power sockets from LÜTZE TRANSPORTATION in the next-generation sleeping car (Tricon Design AG)

AliSa

A key component is "Flex Charge", LÜTZE's concept for an inductive charging solution with magnetic alignment for train applications. This principle enables fast and safe charging while the mobile device remains in use. This is particularly interesting for new interior concepts such as AliSa: the charging technology can be integrated into the interior within easy reach, intuitive use, and minimal space requirements. That is a major advantage in cabins where every inch counts.

LÜTZE is also participating in the AliSa project with compact charging cubes featuring two USB-C ports and 40 W power

all at once, therefore reliable access to power becomes part of a comfortable journey.

LÜTZE has also incorporated a European-standard socket with an integrated USB port into the AliSa model. As the most common market standard today, it offers familiarity: Passengers immediately find the type of connection they expect, while operators benefit from a practical solution that can be integrated into a variety of service and cabin concepts.

LÜTZE's involvement in the AliSa project demonstrates how even the smallest com-

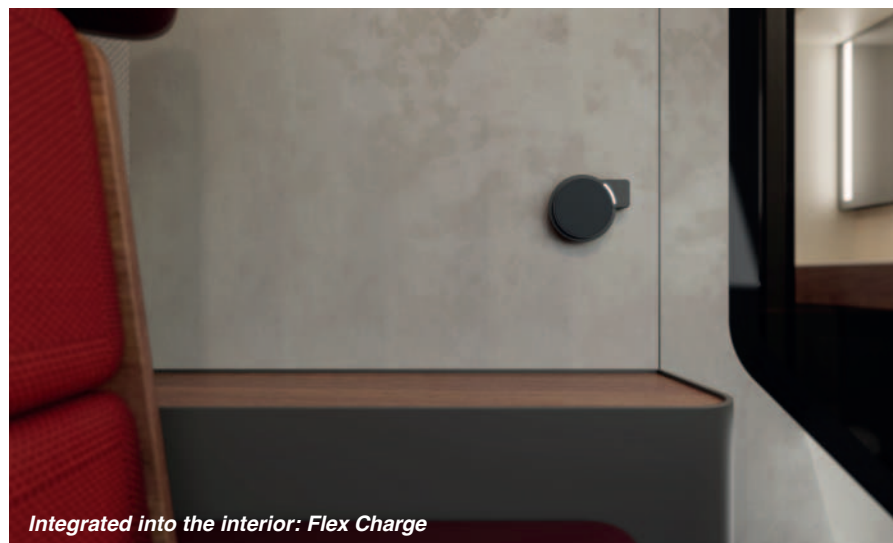
In this way, LÜTZE TRANSPORTATION supports a goal that extends far beyond any single electrical outlet- the continued development of night trains as a modern, attractive, and economically viable mode of transportation. AliSa demonstrates how interior design, structure, and technology must work together to make rail travel more comfortable and sustainable. LÜTZE supplies the connections, both literally and figuratively.



LÜTZE standard sockets for rail applications: USB-C



LÜTZE Schuko socket with integrated USB-C ports



Integrated into the interior: Flex Charge

ponents can play a critical role in shaping the future of travel. As modular sleeping cabins, flexible daytime use, and lightweight construction open up new possibilities, the electrical infrastructure must keep up as it must be safe, durable, easy to maintain, and designed around passenger needs.

ponents can play a critical role in shaping the future of travel. As modular sleeping cabins, flexible daytime use, and lightweight construction open up new possibilities, the electrical infrastructure must keep up as it must be safe, durable, easy to maintain, and designed around passenger needs.

user-friendliness

Standardized configuration solution for greater efficiency and user-friendliness

LÜTZE is expanding its digital solutions portfolio with the new LÜTZE Config Tool – a central software solution for configuring various LÜTZE devices and systems. The aim is to significantly simplify commissioning and configuration while sustainably improving user-friendliness.

Previously, separate software solutions were required to configure programmable timer relays, LCON converters and threshold switches, as well as piezo signal devices. With the new LÜTZE Config Tool, this additional effort is now a thing of the past: users only need a single software solution for all supported devices.

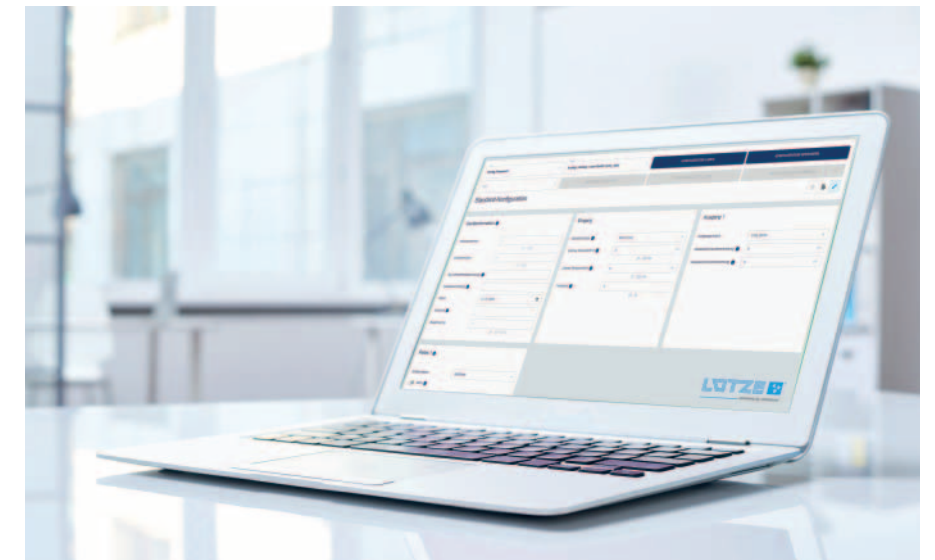
The LÜTZE Config Tool has been deliberately designed to be simple and clearly structured. After selecting the respective product, a well-organized input interface opens with all relevant parameters. A key advantage is the consistent design of the user interfaces: while previous standalone programs featured different layouts, the new tool provides a uniform appearance and significantly improved ease of use. Another added value: the LÜTZE Config

Tool also enables configuration of the Air-BLOWER Control Unit of the AirSTREAM wiring system from the LÜTZE AUTOMATION division. This creates a seamless solution across different product areas.

The LÜTZE Config Tool is now available for free download on the LÜTZE TRANSPORTATION website at www.luetze-transportation.com and on the LÜTZE AUTOMATION website at www.luetze.com. Access is

straightforward: simply enter the article number of the respective device, and the corresponding download page will be displayed directly.

With the LÜTZE Config Tool, LÜTZE offers a modern, practical software solution for Windows® and Linux® that noticeably simplifies users' daily work while increasing efficiency in configuration.



Standardised user interface of the new LÜTZE Config Tool

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We are on Track!

Electronic control for rail vehicles

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