



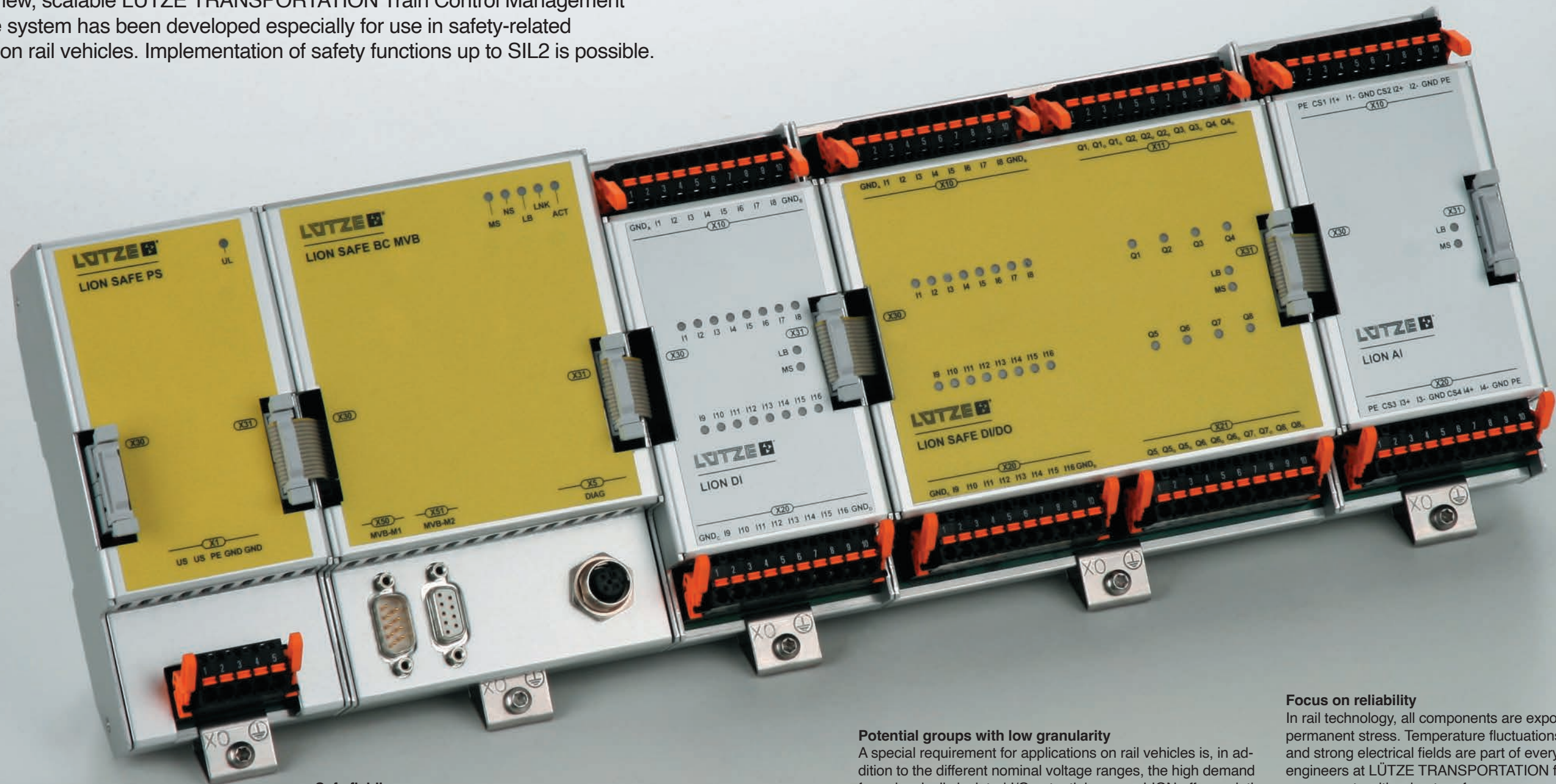
■ Transportation Solutions

LION - Train Control Management System

LION - Safety-related Train

Control Management System

LION is the new, scalable LÜTZE TRANSPORTATION Train Control Management System. The system has been developed especially for use in safety-related applications on rail vehicles. Implementation of safety functions up to SIL2 is possible.



Safety can be expanded in a modular way

With LION it is possible to combine safe and non-safe I/O modules on the same I/O station. Now safety functions can be implemented where required - in decentralised positions.

Safe fieldbuses

LION supports different HEADs with MVB or Ethernet/TRDP interfaces. Depending on the application, a Bus Coupler or a PLC can be used as the HEAD, enabling easy adaptation to different fieldbus systems and control architectures. The safe data transmission is provided by a SDT protocol.

New, safe backplane bus - L-BUS²

The new L-BUS² has numerous diagnostics functions. In this way, users always have an overview of the current status of the TCMS and the connected peripherals.

Potential groups with low granularity

A special requirement for applications on rail vehicles is, in addition to the different nominal voltage ranges, the high demand for galvanically isolated I/O potential groups. LION offers solutions for all nominal voltage ranges, combined with fine granularity and a high packing density.

Process reliability thanks to new connectors

With the pluggable connection level, it is possible to connect sensors and actuators with pre-assembled cables. The plug-in terminals are lockable and can be encoded. This ensures that installation errors and confusion during service are prevented. The innovative push-in technology allows the direct and tool-less wire connection.

Focus on reliability

In rail technology, all components are exposed to very high and permanent stress. Temperature fluctuations, vibrations, impacts and strong electrical fields are part of everyday operation. The engineers at LÜTZE TRANSPORTATION focus on high-quality components with robust performance.

Standards and approvals

As an IRIS-certified company, the hardware and software development of the LÜTZE TRANSPORTATION is based on strict quality regulations.

The LION system has been developed according to national and international approval criteria such as EN 50155, EN 50121-3-2, EN 61373, EN 50124-1, EN 50126, EN 50128 and EN 50129.

LION - Safety-related TRAIN Control Management System

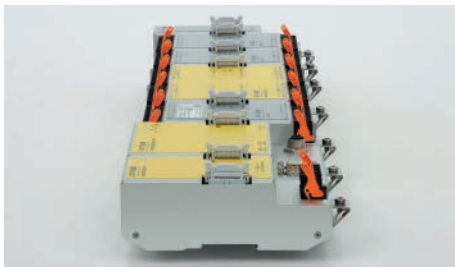
Safety



LÜTZE TRANSPORTATION consistently pursues its aim of making safety affordable and enables the scaling of safety functions through the modularity of the LION system from SIL0 to SIL2.

With LION, safe (SIL2) and non-safe (SIL0) modules can be operated together on the same bus. A separate network installation for processing safety-relevant signals is no longer required.

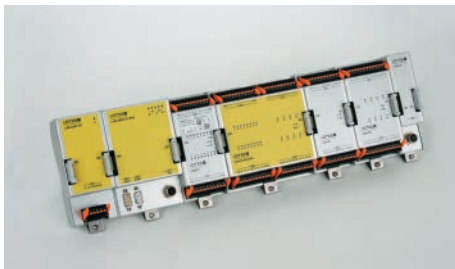
Modularity



The modular structure of the systems allows the user to create individually-configured I/O stations, depending on the installation location and the assigned task.

Compact I/O nodes are not flexible and clearly at a disadvantage in comparison to LION.

Flexibility



With LION it is extremely easy and flexible to configure additional I/O units within one system. For example during an advanced project phase if additional requirements occurring and thus additional I/O channels are necessary.

LION supports HEADs with different fieldbuses. Depending on the application, a Bus Coupler or a PLC can be used as the HEAD, enabling easy adaptation to different fieldbus systems and control architecture

Reliability



In the LION, only materials are used, which are consistently of good quality over the entire product lifecycle. In order to achieve this goal, the high requirements of European operators - such as Deutsche Bahn and SNCF - are incorporated into the product. Gold-plated contacts and stainless steel connections are an inherent part of LION.

Furthermore, innovative production technologies are used, such as an automated coating process or complete traceability of components.

Safe backplane bus

L-BUS²

The backbone of LION is the internal, safe L-BUS² (LÜTZE bus), via which all data is exchanged between the I/O modules and the HEAD (BC or PLC). The L-BUS² operates internally via an RS485 physical interface and controls communication, addressing and power supply of all I/O modules.

In case of a malfunction of one or several I/O modules, the HEAD can reliably detect this malfunction and continue to address the intact modules. The functionality and availability of the overall system are retained in spite of the malfunction.

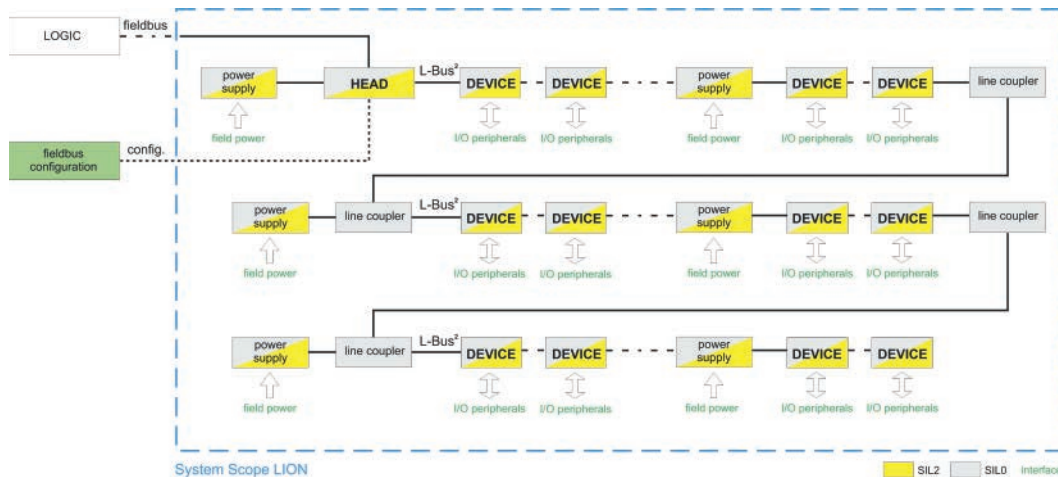
Product Overview - LION

Type	SIL	ID	Part.Nr.	Description	
Infrastructure Components	2	200	800101	Safe Power supply unit 72 W with wide range input DC 24 V ... 110 V and redundant input connector	
	2	201	800103	Safe Power supply unit 36 W with wide range input DC 24 V ... 110 V	
	0	1200	800111	Power supply unit 72 W with wide range input DC 24 V ... 110 V and redundant input connector	
	0	1201	800113	Power supply unit 36 W with wide range input DC 24 V ... 110 V	
	0	2700	800102	Line Coupler L-BUS ² M12	
PLC	2	--	802106	Safe PLC NFB-NFB <i>"only TRDP field bus"</i>	<i>new</i>
	2	--	802107	Safe PLC COS-MVB	<i>new</i>
	2	--	802108	Safe PLC COM-MVB	<i>new</i>
	2	--	802109	Safe PLC CAN-MVB	<i>new</i>
Micro PLC	0	--	802211	LION-MICRO-PLC-CAN-16/8/21 <i>"Standalone system, no I/O modul extension possible"</i>	
Bus Coupler	2	102	803001	Safe Bus Coupler MVB	
	0	2102	803011	Bus Coupler MVB	
	2	103	803002	Safe Bus Coupler Ethernet/TRDP	
	0	2103	803012	Bus Coupler Ethernet/TRDP	
Digital Inputs	0	2300	803101	Digital Input module, 16 channels, DC 24 V ... 36 V	
	0	2301	803102	Digital Input module, 16 channels, DC 72 V ... 110 V	
	2	300	803103	Safe Digital Input module, 16 channels, DC 24 V ... 36 V	
	2	301	803104	Safe Digital Input module, 16 channels, DC 72 V ... 110 V	
Digital Outputs	0	2401	803202	Digital Output module, 16 channels, DC 24 V, 2 potential groups	
	0	2402	803203	Digital Output module, 8 channels, DC 24 V ... 110 V	
	0	2400	803201	Relay Output module, 8 channels, DC 24 V ... 150 V	
	0	2403	803204	Digital Output module, 16 channels, DC 24 V, 4 potential groups	
Analog Inputs	0	2501	803301	Analog Input module, 4 channels, 0 ... 10 V	
	0	2502	803302	Analog Input module, 4 channels, 0 ... 20 mA	
	0	2500	803303	Analog Input module, 4 channels, PT100	
	0	2503	803304	Analog Input module, 4 channels, PT1000	
	0	2504	803306	Analog Input module, 4 channels, +/- 10 V	
	2	500	803305	Safe Analog Input module, 4 channels, 4 ... 20 mA	
Analog Outputs	0	2600	803401	Analog Output module, 4 channels, 0 ... 10 V	
	0	2601	803402	Analog Output module, 4 channels, 0 ... 20 mA	
	0	2602	803403	Analog Output module, 4 channels, +/- 10 V	
Safe Input and Outputs	2	900	803501	Safe Digital Input / Output Module SIL2 16 safe input channels, DC 24 ... 36 V 8 safe output channels, DC 24 V ... 110 V	
	2	901	803502	Safe Digital Input / Output Module SIL2 16 safe input channels, DC 72 ... 110 V 8 safe output channels, DC 24 V ... 110 V	

LION - Safety-related TRAIN Control Management System

System Architecture

An I/O station always consists of a power supply (PS), a HEAD (Bus Coupler or PLC), and at least one I/O expansion module. Up to 32 I/O modules can be connected in any combination.



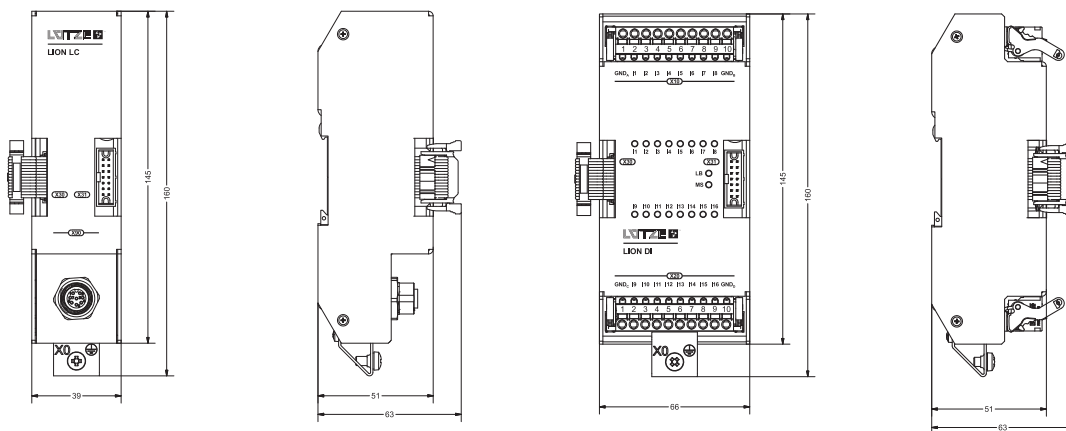
The I/O modules can be installed on different "lines". The connection between the individual lines is established via a line coupler (LC). By using line couplers, I/O modules of one line can be connected at a distance of up to 10 metres to the previous line of the I/O station.

A maximum of two line changes is possible.

When a PLC is used as the HEAD, the system can operate either as a modular I/O station with up to 32 I/O modules or as a standalone control unit without any connected I/O modules.

Design

The system is installed without the need of tools onto DIN rail profiles.



Due to the flat design of the modules and any installation position on the DIN rail profile, the system is perfect for areas with limited space, such as the driver's cab of a locomotive.

Advantages in Safe Architectures

Redundancies are very cost intensive

LION generates high saving potentials through its use of 1-channel architectures.

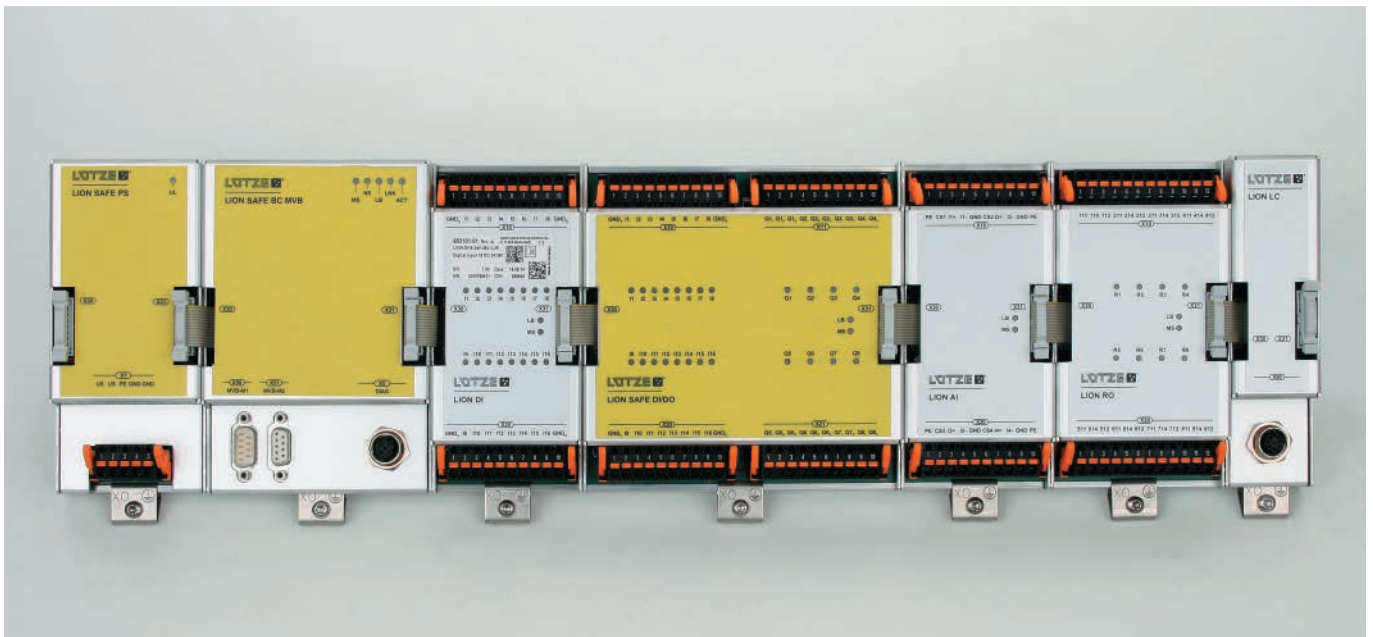
LION can work without additional fieldbus networks for safety circuits

With LION, the available network installation can still be used. It is sufficient to use a suitable, application-specific safety software with an appropriate safety protocol. Safety and non-safety I/O stations can thus be operated on the same network. These features have a positive effect on the cost and vehicle weight.

LION provides clear advantages in comparison to compact safety nodes.

LION allows the scaling of safe I/O channels. The modular architecture allows the direct coupling of safe modules to non-safe modules. It is no longer necessary to install special safe I/O nodes. Safety functions in the train can now be implemented where they are really required. This is possible because LION supports the operation of safe and non-safe I/O modules on the same I/O node.

LION I/O stations can be connected via a standard fieldbus such as the MVB (IEC 61375-3-1) or the TRDP (IEC 61375-3) to the vehicle control. Here the data transmission must be sufficiently protected. This is achieved using an error detection mechanism. In LION, the standardised protocol SDT (IEC 61375-2-3) is used.



Because of the safe L-BUS², safe and non-safe I/O modules can be operated in any combination on the same I/O station.

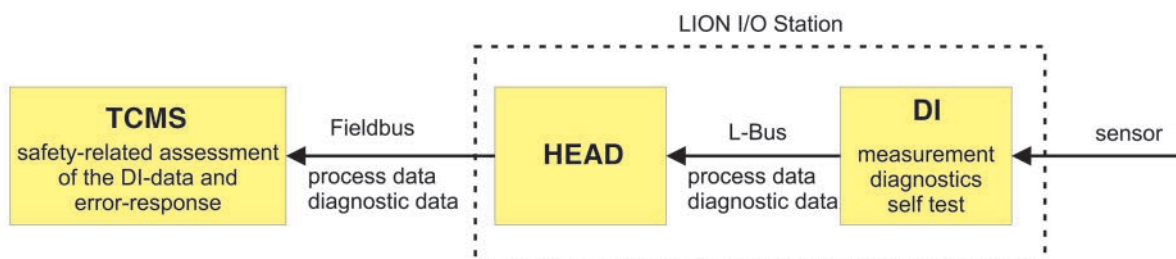
LION - Safety-related TRAIN Control Management System

LION Safety Concept

The L-BUS² ensures the safe transport of process and diagnostics data between the HEAD (BC or PLC) and all connected modules. The software of the non-safe modules was developed according to the normed and standardised development process of the EN 50128.

The SIL0 modules share the L-BUS² with the SIL2 modules but have no impact on the safety-related system behavior. The field level of the modules is galvanically isolated.

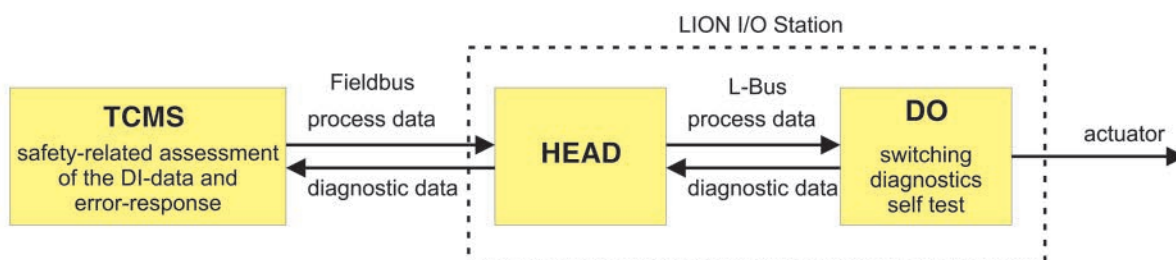
In the following examples, the HEAD is represented by a Bus Coupler. The same architecture and safety behavior apply when a LION PLC is used as the HEAD of the I/O station.



Safe inputs

The I/O module transfers the process input and diagnostics data via the HEAD to the control unit using a safe fieldbus protocol. The control unit assesses the data based on the diagnostics information, decides on its validity and processes a safe reaction in case of malfunction.

Errors can be detected through diagnostics and self-test functions within the digital inputs as well as in the HEAD. This leads to setting the inputs to zero in the process data and to the marking of invalid values in the diagnostics data. Non-controllable errors in the I/O module lead to a failsafe condition.

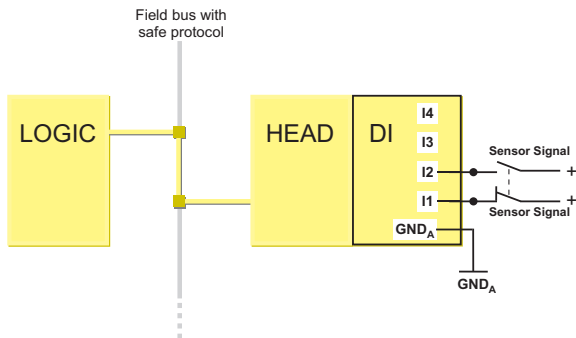


Safe outputs

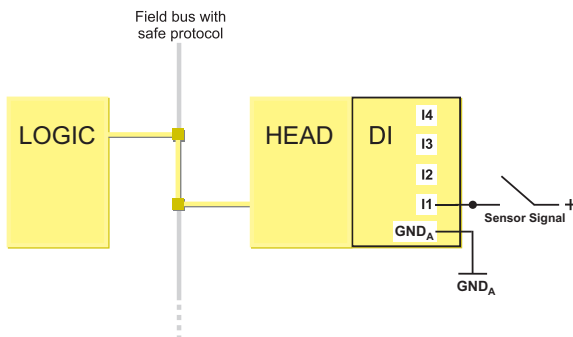
The I/O module switches the outputs and determines the diagnostic data. The diagnostic data are sent by the HEAD via a safe protocol to the control unit. The control unit processes the relevant safety function based on the diagnostic information.

Errors can be detected by diagnostics and self-test functions within the digital outputs and the HEAD. This leads to switch-off of the outputs and to an error message by the diagnostic data. Non-controllable errors in the I/O module lead to the failsafe mode and the switching off of the outputs.

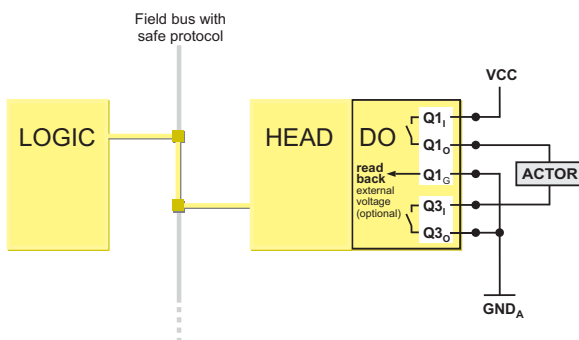
Safety Architectures Examples with LION



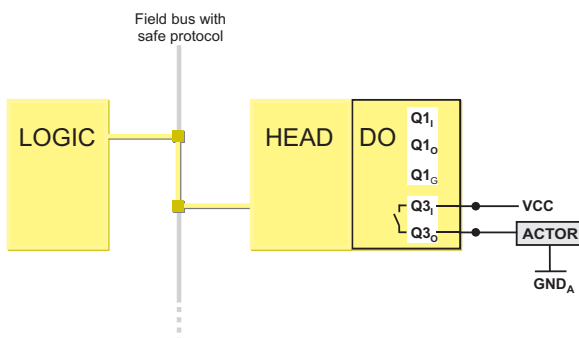
With this architecture pattern, the safety level SIL2* can be achieved. Here the input signal is read in a redundant/antivalent way. The user must ensure that a plausibility check of the acquired signals is performed in the control unit. Two input channels are required for the antivalence. Users are free to choose which inputs are used. Two neighbouring input channels or, for example, two inputs from different modules or I/O stations can be combined.



For SIL1* applications, any safety-relevant input channel can be used. Here the input signal of the sensor is read via one channel. All inputs are cyclically monitored with test pulses to reveal the error status "Stuck-at-High". A total of 16 input channels are available per safety I/O module.



In order to achieve safety level SIL2*, an architecture pattern can be used in which the actuator is controlled via plus/minus-switching. Here two output channels are used. The user is free to choose which outputs are used for the purpose. Two neighbouring output channels or, for example, two outputs from different modules or I/O stations can be combined. In this example the additional function external voltage detection is used which is optionally available.



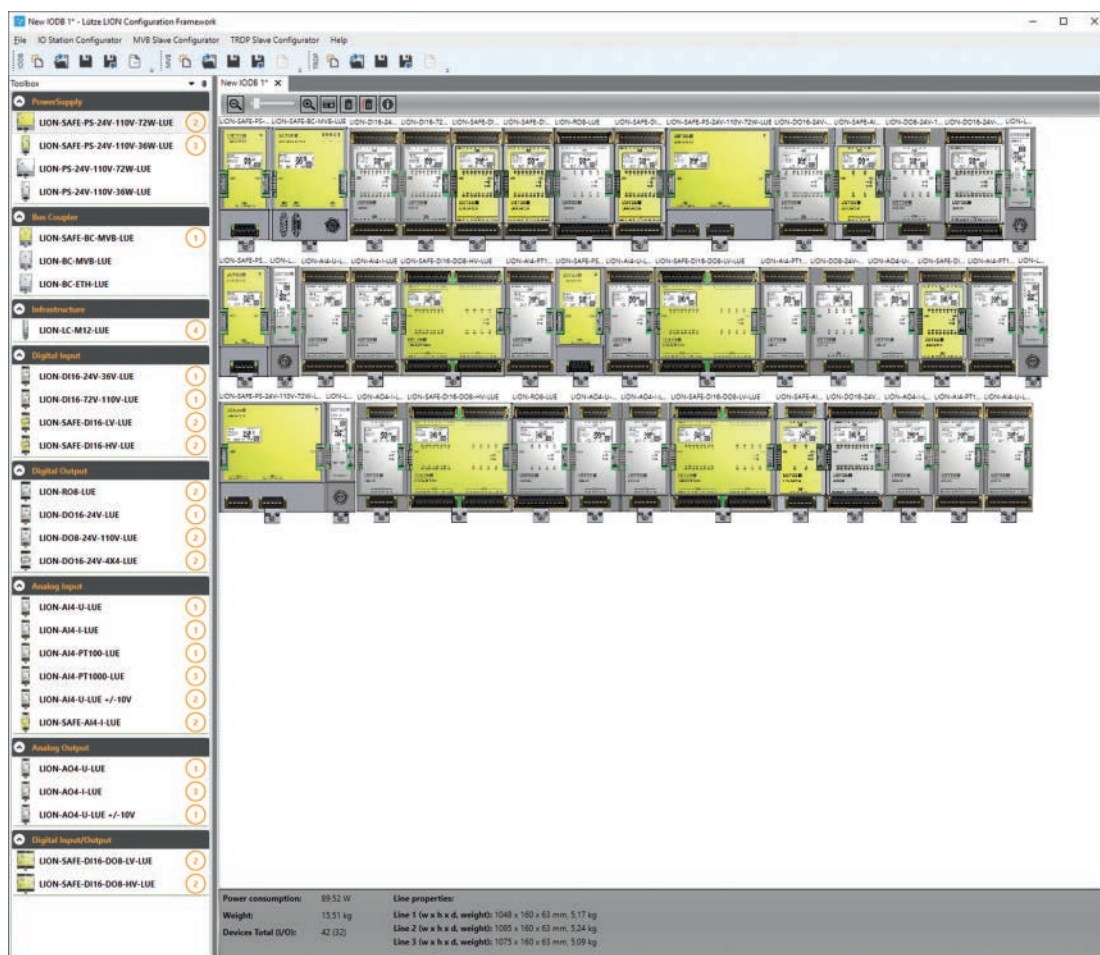
In order to achieve safety level SIL1* it is sufficient to switch the output signal via one channel. Here the outputs are monitored in channel granular manner. The user can read back the current switching condition of the transistor to the internal module monitoring (detection of Stuck-On errors) in order to diagnose other error statuses such as short-circuits or overload. A total of 8 output channels are available per safety-relevant I/O module.

*The achievable SIL level depends on the Failure Rate of the overall system. (EN 50129)

LION - Safety-related TRAIN Control Management System

LION Configuration Framework

The LION Configuration Framework is an innovative software platform of the LION system. It supports the user during all project phases, starting with the planning of the I/O stations via the field bus configuration right up to the supporting documentation for the safety verification.



The main components of the continuously maintained software tool LION Configuration Framework are the LION I/O Station Configurator, the LION MVB Slave Configurator and LION TRDP Slave Configurator

The LION Configuration Framework can be downloaded free of charge from www.luetze-transportation.com.

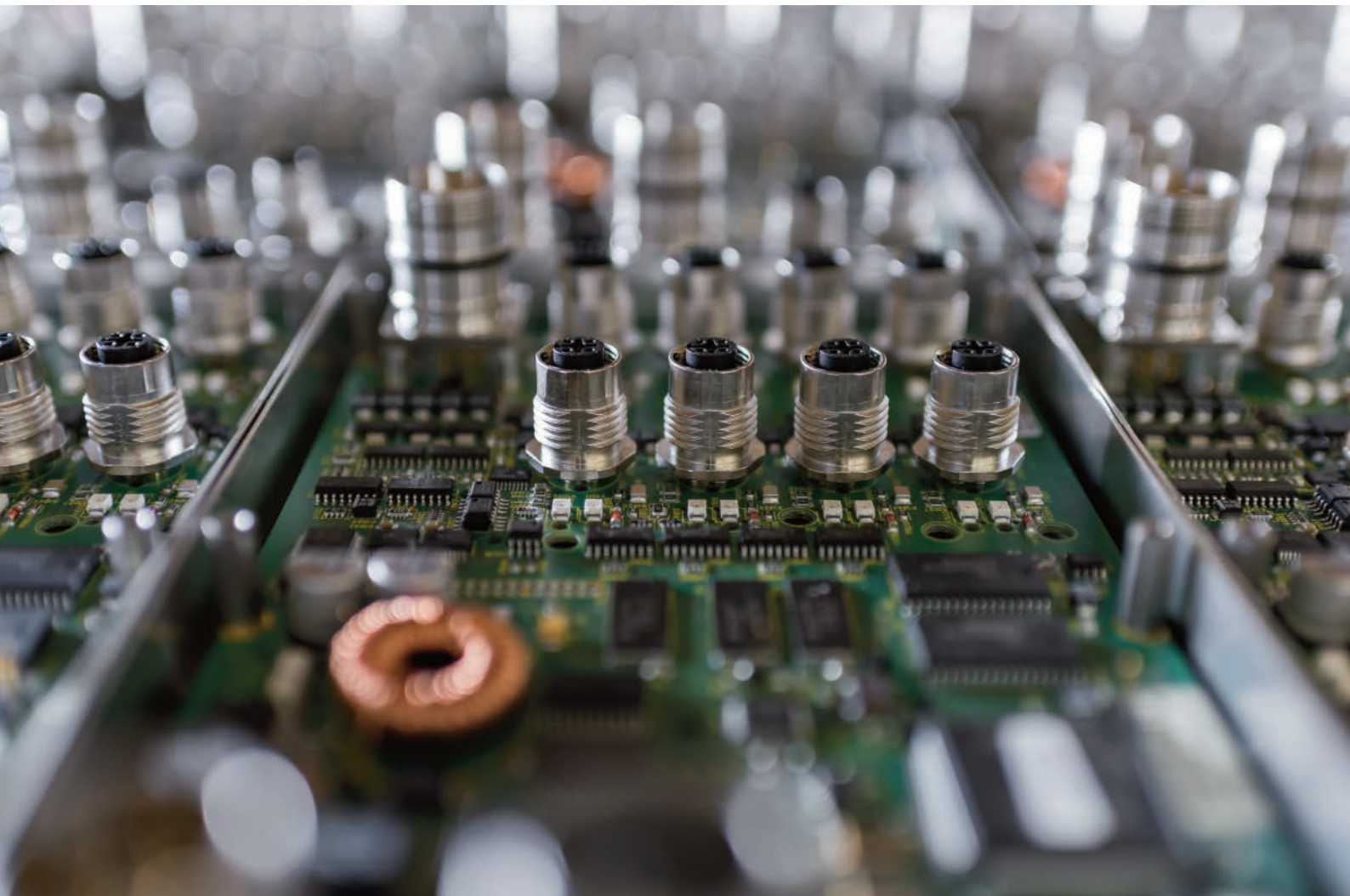
Railway Technology Competence



LÜTZE has been developing and manufacturing electrical components for rail vehicles for over 40 years. Our extensive product range of standard components carries out many automation tasks in the most diverse vehicle applications.

Are you still looking for the appropriate product adapted to suit your specific application?

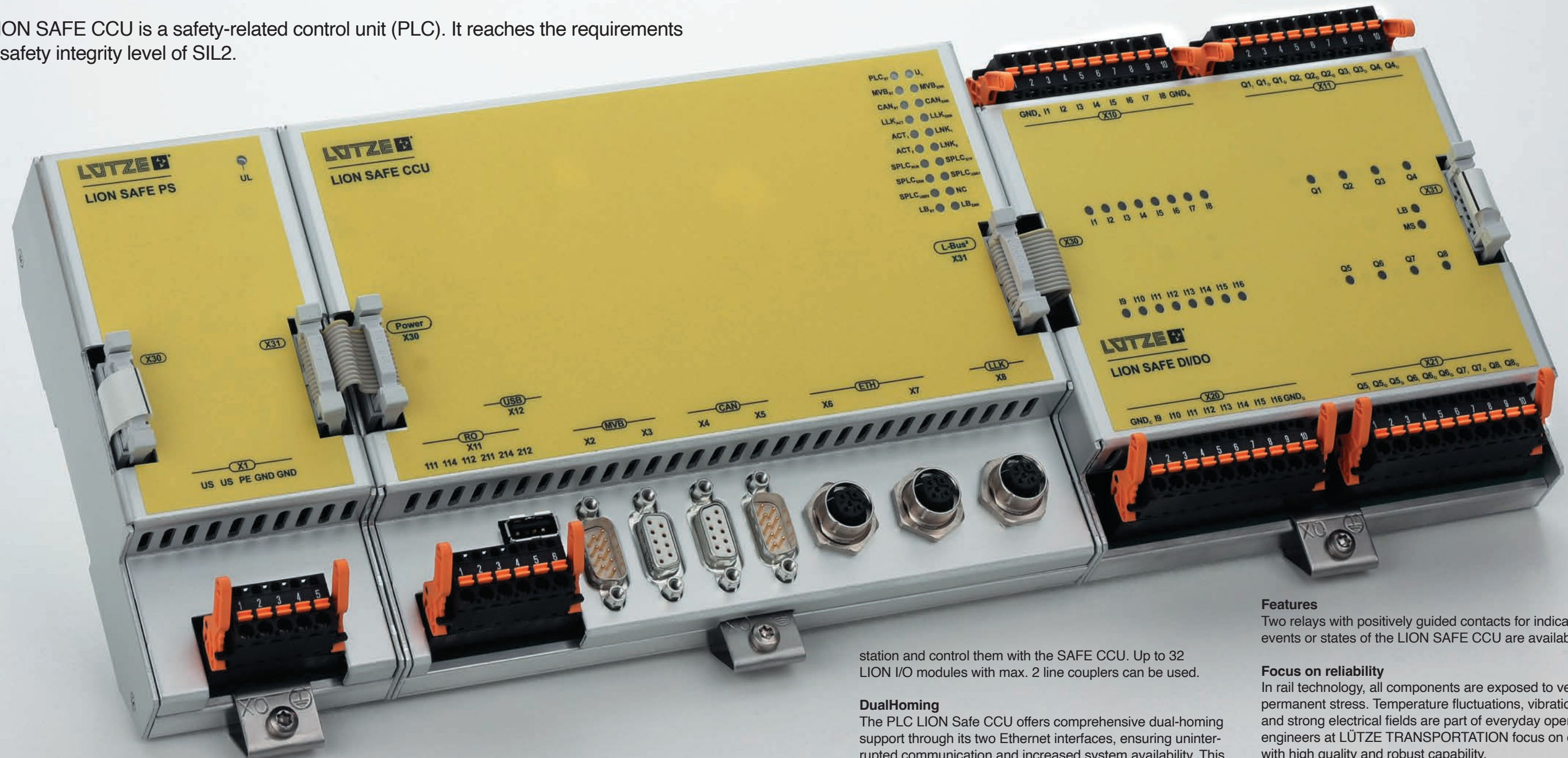
Get in touch with us. Our developers help you find the best solution for your application, including the specification and design for the application on the vehicle, regardless of whether you need components for your control technology, interface components or optical and acoustic signalling devices.



LION - Safety-related Train

Control Management System

The LION SAFE CCU is a safety-related control unit (PLC). It reaches the requirements of the safety integrity level of SIL2.



Programming

The LION SAFE CCU is programmed using two independent and convenient IEC 61131 development tools for safe and non-safe applications. Data can be exchanged between safe and non-safe applications via a common interface.

Validation and homologation process

The validation and homologation process is simplified and shortened, especially when only non-safe code is modified, e.g. during the commissioning phase.

New, safe backplane bus – L-BUS²

The LION SAFE CCU uses the new L-BUS² so it is possible to combine safe and non-safe I/O modules on the same I/O

station and control them with the SAFE CCU. Up to 32 LION I/O modules with max. 2 line couplers can be used.

DualHoming

The PLC LION Safe CCU offers comprehensive dual-homing support through its two Ethernet interfaces, ensuring uninterrupted communication and increased system availability. This feature helps to prevent failures and maximize operational safety, resulting in a reliable application solution. This significantly enhances the robustness and reliability of the system.

Safe fieldbuses

LION SAFE CCU provides flexibility by using different fieldbus interfaces at the same time in one application. MVB, CANopen, CAN2.0 (J1939), Ethernet/TRDP can be used. The safe data transmission is provided by an SDT protocol.

Features

Two relays with positively guided contacts for indication of events or states of the LION SAFE CCU are available.

Focus on reliability

In rail technology, all components are exposed to very high and permanent stress. Temperature fluctuations, vibrations, impacts and strong electrical fields are part of everyday operation. The engineers at LÜTZE TRANSPORTATION focus on components with high quality and robust capability.

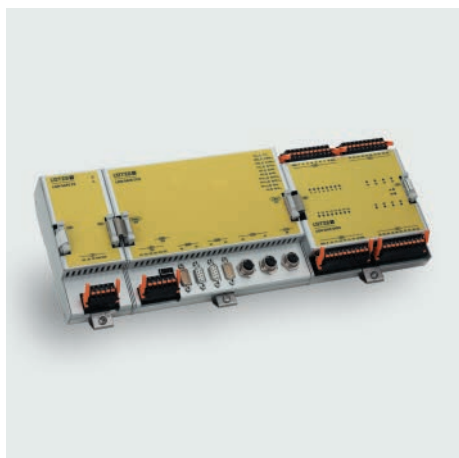
Standards and approvals

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The LION system has been developed according to national and international approval criteria such as EN 50155, EN 50121-3-2, EN 61373, EN 50124-1, EN 50126, EN 50128 and EN 50129.

LION - Safe Compact Control Unit

LION SAFE CCU – Scalable Safety Control Intelligence



The LION SAFE CCU is a train control unit and can be used for applications up to a safety level of SIL2. The safety-related and non-safe application software code can coexist within the same control unit without any mutual interference.

Key features

- Capable for use as a control unit in safety-related applications up to SIL2
- Compliant with the standards EN 50126, EN 50128, EN 50129, EN 50155, EN 50159, EN 50121, EN 45545
- Comfortable software development of safe and non-safe code with one development tool
- No need of complex validation process if only non-safe modifications are made
- Time-effective programming phases, saving of development process cost

Technical Data

Part Number	802106 / 802107 / 802108 / 802109
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CPU

CPU 1	CPU Sitara AM4379 Cortex A9 1GHz Safe CPU with safe OS, safe scheduler and safe redundant runtime system
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Communication Interfaces

Fieldbus *	MVB Slave EMD Interface with SDTv2 safety protocol layer
Fieldbus 2*	CAN Interface available as CANopen Slave, CANopen Master, CAN2.0
Fieldbus 3	Ethernet Interface for TRDP with SDTv2 (Dual Homing) or standard TCP/IP
Local Bus 1	L-BUS ² Interface for connection of local safety-related I/O modules
Local Bus 2	LUETZE-LINK-Interface for generic integration of safe 3rd party devices
	* Part number 802106 without field bus 1 and 2

Other Interfaces

Relays	Two relays with positive driven contacts for indication of events or states
USB Interface	USB Host for flash drives for firmware & program updates, system logging
RTC	On-board Real Time Clock during runtime

Power Supply

Operation Voltage	DC 24 V ... 110 V (via LION PS Module)
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Software

Programming	via Ethernet Interface
Diagnostic	via Web Interface
Safety Programing	
Environment	SafeOS and SafeProg
Standard Programing	
Environment	FreeRTOS TM and Multiprog

LION - Safe Compact Control Unit

LION micro PLC



The **LION microPLC** is a compact PLC with local Input and Output channels and can be used for decentralized control applications on trains. The internal modular concept is designed to create customized control solutions.

Key features

- Capable for use as a control unit in decentralized areas for small applications for example: sanding units, sanitary cubicles, windscreen wipers, compressors, etc.
- Compliant with the standards EN 50155, EN 50121, EN 45545, EM V06
- Built-in PLC simulator
- Test framework and static code analysis

Technical Data

Part Number 802211

CPU

Main Processor	ARM CORTEX M4 168 MHz
Programm Memory	512 kB FLASH as programm Memory 32 kB integrated SRAM as variable Memory
RTC	Real Time Clock (RCT) during runtime
USB Interface	Debugging / Programming
Performance	100.000 binary operations (bool, Byte, Int, DInt) in approx. 3.3 ms 100.000 real operations in ca. 94.5 ms

Communication Interfaces

Fieldbus 1	CAN2.0
Fieldbus 2	Ethernet Interface for generic for standard TCP/IP or UDP/IP communication
Fieldbus 3	Configurable serial Interface as RS485, RS422, RS232 galvanic isolated

Local I/O Channels

Digital Inputs	16 channels, DC 24 V
Digital Outputs	8 channels, DC 24 V / 0,5 A
Analog Inputs	2 channels, DC 0 ... 10 V, 12bit resolution
Analog Outputs	1 channel, DC 0 ... 10 V, 12bit resolution

Power Supply

Operation Voltage	DC 24 V (range DC 16.8 ... 30 V)
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Software

Operating System	real-time operating system: FreeRTOS™
Runtime System	Neuron RTS micro
Programming	via Ethernet Interface
Programing Environment	LÜTZE TRANSPORTATION Power Engineer
Programing Language	languages defined in IEC 61131-3 - FBD, ST, IL, SFC, C

Technical data

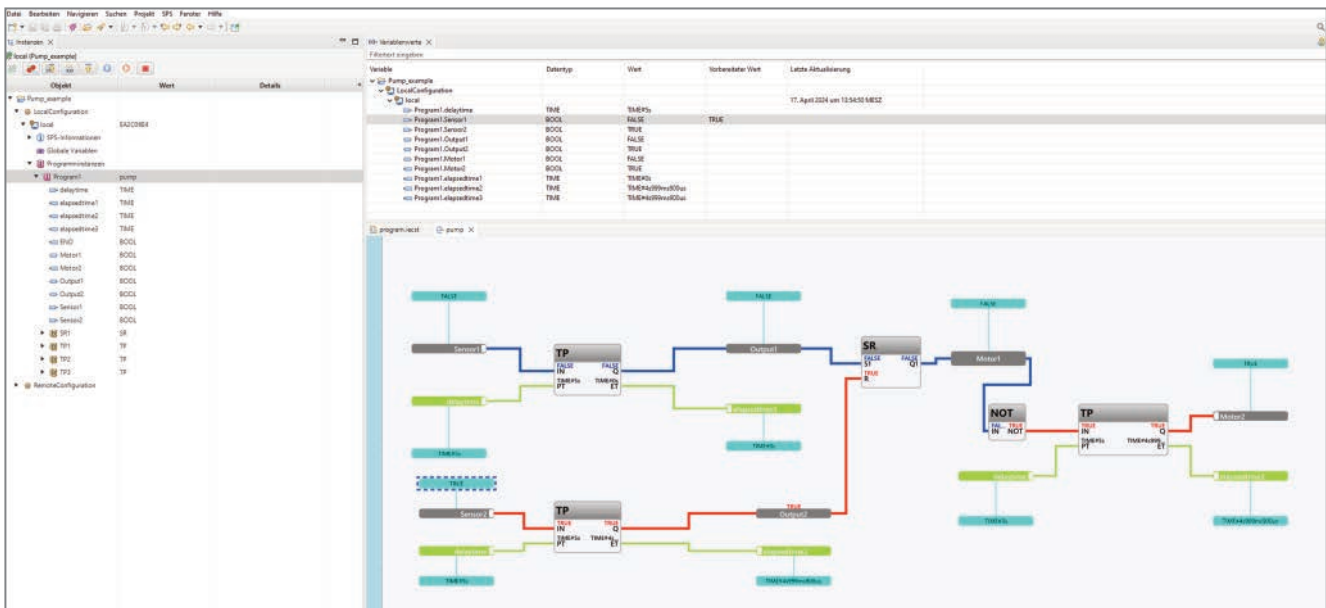
Dimensions (w x h x d)	158.0 mm x 16.0 mm x 58.0 mm
Weight/unit	0.71 kg
Installation position	As desired

Software Engineering Tool Neuron Power Engineer

Neuron Power Engineer – Your Powerful Development System for Modern Controls from LÜTZE!

Discover the Neuron Power Engineer, the new, high-performance development system compliant with IEC 61131-3, designed to make programming control applications easier and more comfortable than ever before. With its intuitive operation and clear color coding, programming becomes a breeze.

Whether for safe or non-safe applications, the Neuron Power Engineer combines everything into a single tool. This saves you valuable time and money on the maintenance and care of your systems, allowing you to handle everything conveniently in one step.



The integrated test framework enables you to verify your program code safely and efficiently. Functions can be tested in advance, reducing or even eliminating the need for extensive troubleshooting. Especially for safe applications, the test framework offers significant advantages: changes or corrections are automatically checked against existing expectations, ensuring you are always on the safe side.

In addition, the Neuron Power Engineer supports the creation of function blocks (FBs) as well as user libraries and C libraries. Developers familiar with the C programming language will find a simple and efficient way to program and operate PLC controls.

Integration into a management system allows multiple people to work on a project simultaneously without creating different project versions. It also provides secure management of version control.

Through static code analysis, rule violations are detected and corrected during development, significantly improving the readability and understanding of the program code.

Rely on the Neuron Power Engineer and experience a new dimension of programming – efficient, safe, and user-friendly!

Certificate

LÜTZE is ISO 22163:2023 / IRIS Rev.04 certified

In 2007, LÜTZE was among the first 25 companies worldwide to obtain the new Railway Industry Standard IRIS certification. In 2024, compliance with the IRIS Rev.04 standard was successfully achieved. With the transition to the ISO 22163:2023 Standard IRIS goes significantly further than the requirements of the ISO 9001 standard and incorporates additional railway-specific requirements.

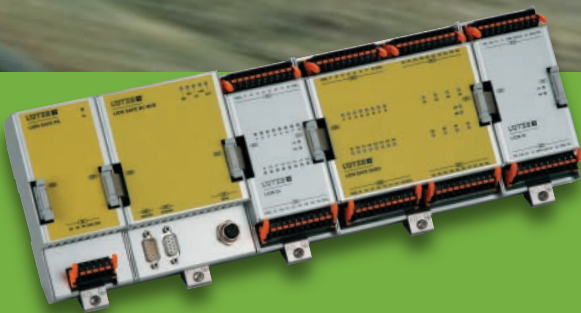


As a specialist in electronic components in rail vehicles, LÜTZE is aware of the high standards that your applications require from our products. Based on this quality awareness and our claim of supporting you with the latest technologies and designing your products reliably and cost-effectively, we have developed into the leading supplier in this market. In addition to the certification according to DIN EN ISO 9001:2015 LÜTZE also documents its leading position by means of a certified management system in accordance with the International Railway Industry Standard, IRIS.

IRIS is a standardized method used worldwide for assessing the management systems of suppliers, which takes specific standards for the rail vehicle industry into account. With the IRIS certification, we have made another important step in the continual improvement of collaboration with you, our customers from the rail industry and we are looking forward to supporting you even better in your next projects.

We are on Track!

Electronic control for rail vehicles



Control Technology



Interface



Indication



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