



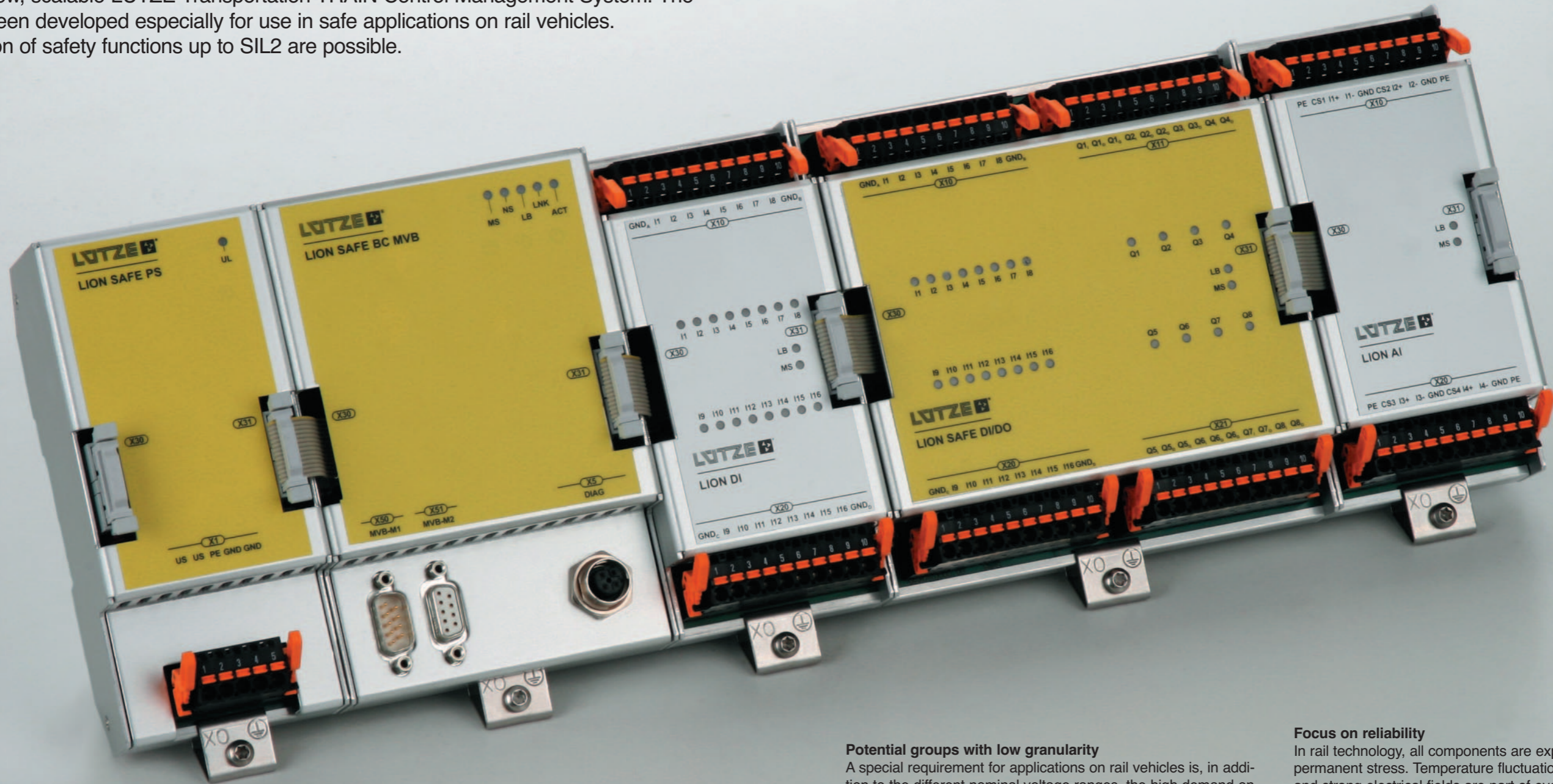
■ Transportation Solutions

LÜTZE Rail Technology

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 safe applications on rail vehicles. Implementation of safety functions up to SIL2 are possible.



Safe fieldbuses

LION provides flexibility by using different fieldbus interfaces in one application. Bus couplers with MVB or TRPP interface are available. 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.

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.

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 on galvanic 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 confusions during service are prevented. The innovative push-in technology allows the direct and toolless 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 of LÜTZE Transportation are focussing on components with high quality and robust capability.

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

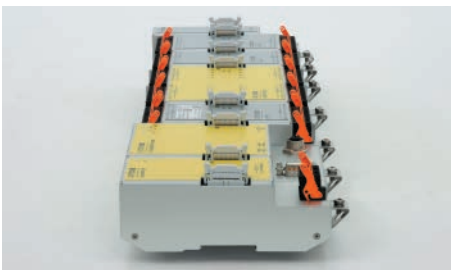
Safety



LÜTZE Transportation consistently pursues their aim of making safety affordable and allows through the modularity of the LION system the scaling of the safety functions 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.

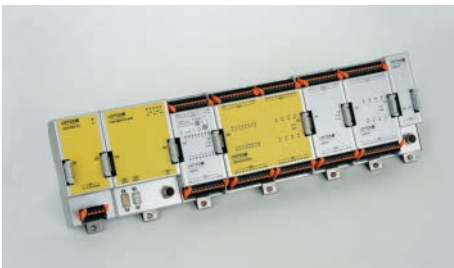
Modularity



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 at one system. For example during an advanced project phase if additional requirements occur and thus additional I/O channels are necessary.

On the LION, two different bus couplers can be operated with MVB or Ethernet interfaces. By replacing the bus coupler, users can easily switch between different fieldbus systems.

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 tracing of components.

Safe backplane bus

L-BUS²

The backbone of LION is the internal, safe L-BUS² (LÜTZE bus), via all data is exchanged with 4.5 Mbit/s between the I/O modules (slaves) and the bus coupler (master). The L-BUS² is internally operating via a 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 master can unambiguously record this malfunction and continue to address the intact modules. The functionality and availability of the overall system is retained in spite of the malfunction.

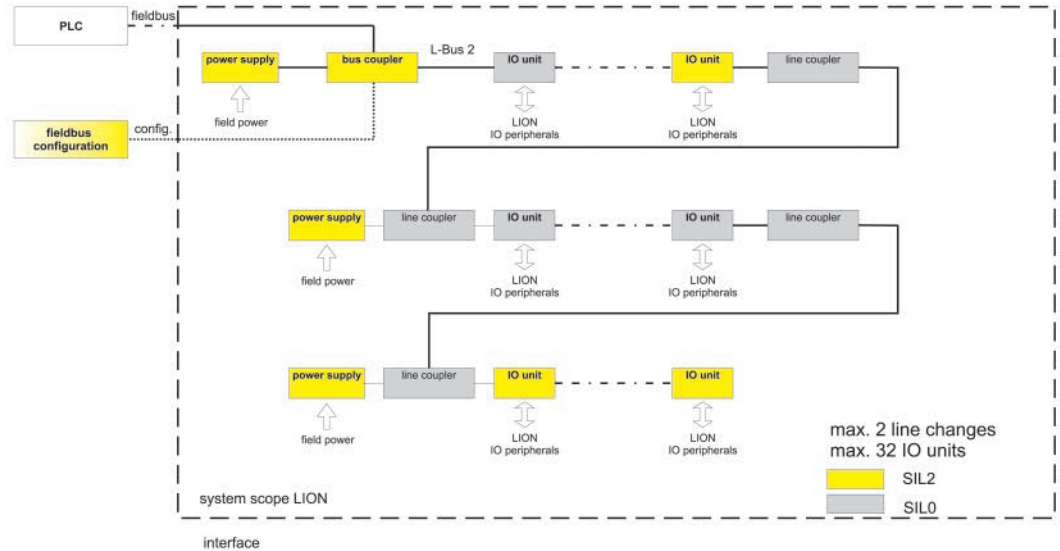
Product Overview - LION

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 <i>new</i>
	0	1201	800113	Power supply unit 36 W with wide range input DC 24 V ... 110 V <i>new</i>
	0	2700	800102	Line Coupler L-BUS ² M12
PLC	2	150	802104	SAFE PLC COS-MVB-ETM
	2	150	802105	SAFE PLC COM-MVB-ETM
Micro PLC	0	--	802201	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
	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 <i>new</i>
	2	301	803104	Safe Digital Input module, 16 channels, DC 72 V ... 110 V <i>new</i>
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 <i>new</i>
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 <i>new</i>
	2	500	803305	Analog Input module, 4 channels, 4 ... 20 mA <i>new</i>
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 <i>new</i>
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 bus coupler (BC) and at least one I/O expansion module. The I/O station can be operated with up to 32 I/O modules in any combination.



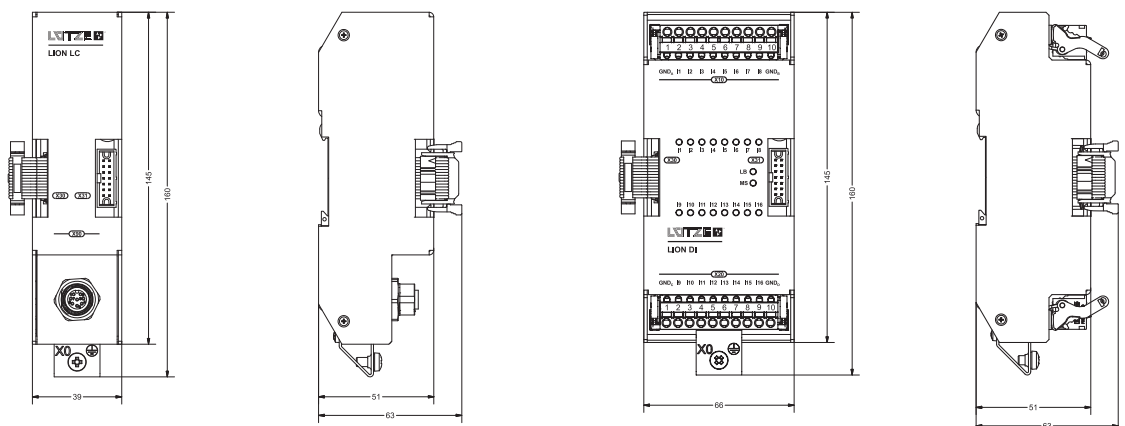
The I/O modules can be installed on different "lines". The connection between the individual lines is done via a line coupler (LC).

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.

In total 2 line changes are possible.

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.

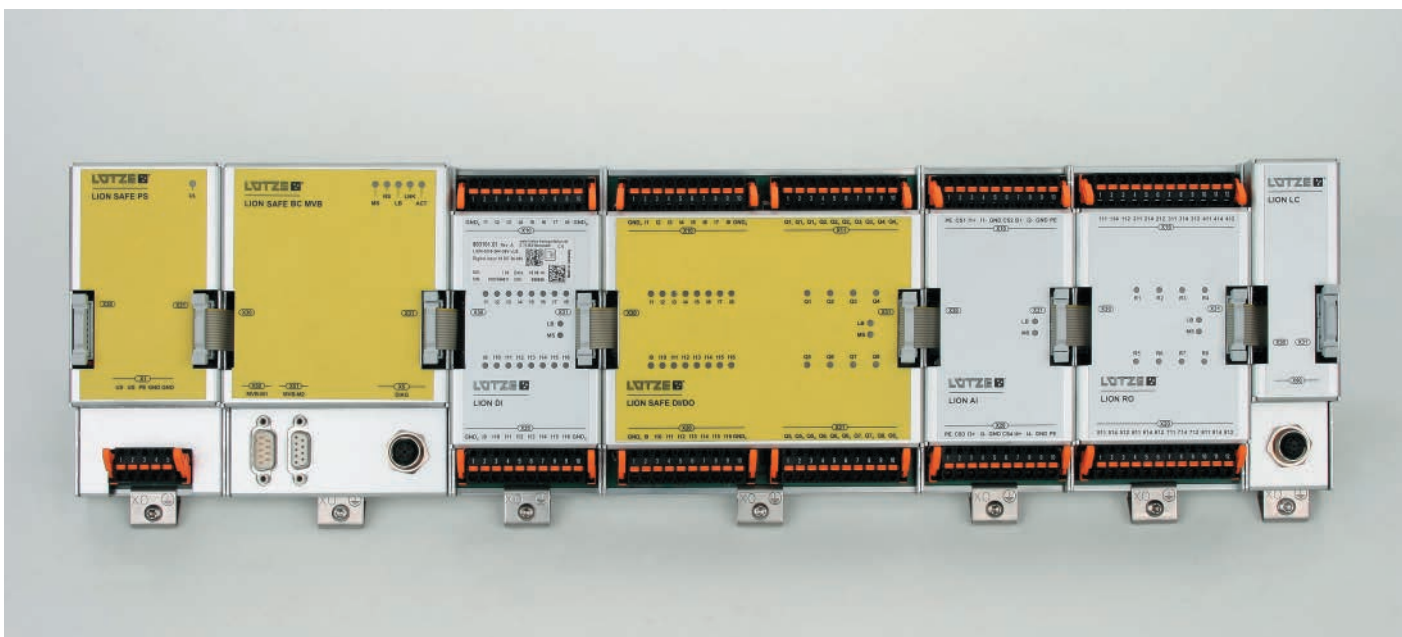
LION can work without additional fieldbus networks for safety circuits

With LION, the available network installation can still be used. It is sufficient to use a suitable, applicable safety software attachment in terms of protocolling. 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 61375-3-1/3-2) or the TRDP (IEC 61375-3-4) 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.



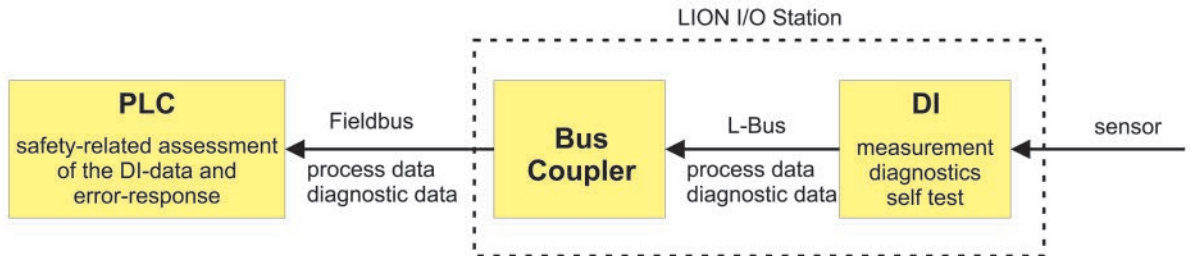
Because of the safe L-BUS², safe and non-safe I/O modules can be operated in any combination on the same I/O station.

LION - Safety-related TRAIN Control Management System

LION safety concept

The L-BUS² ensures the safe transport of process and diagnostics data between the bus coupler and all connected modules. The software of the non-safe modules were developed according to the normed and standardised development process of the EN 50128.

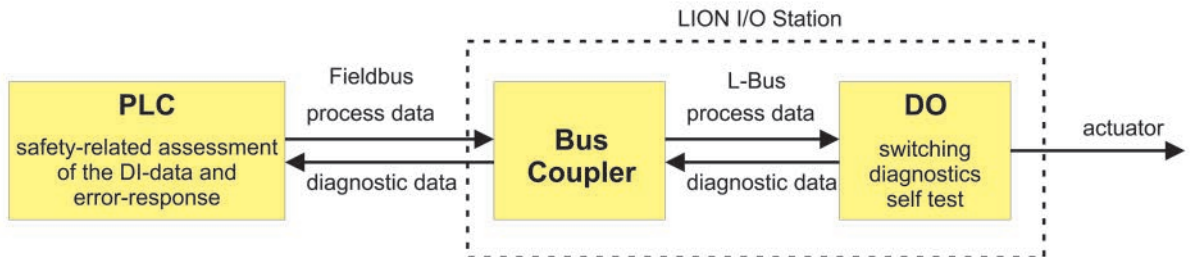
The SIL0 modules communicate in absent of reaction on the L-BUS². The field level of the modules is galvanically isolated.



Safe inputs

The I/O module transfers the process input and diagnostics data via the bus coupler 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 bus coupler. This leads to zero setting of the inputs 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.

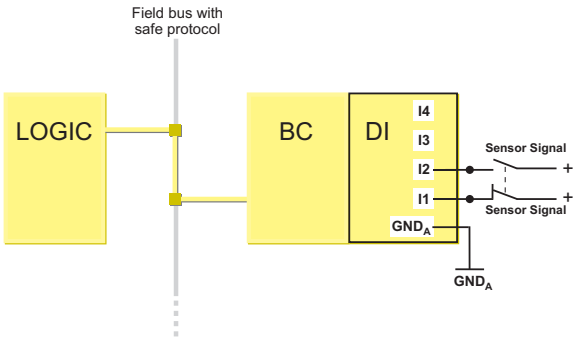


Safe outputs

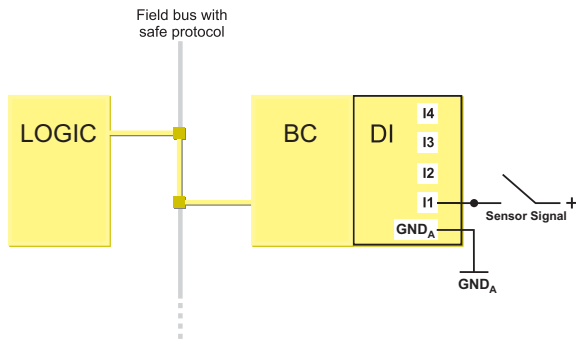
The I/O module switches the outputs and determines the diagnostic data. The diagnostic data are sent by the bus coupler via a safe protocol to the control unit. The control unit processes the relevant safety function based on the diagnostic information.

Errors can be detected by diagnostics and self-test functions within the digital outputs and the bus coupler. 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.

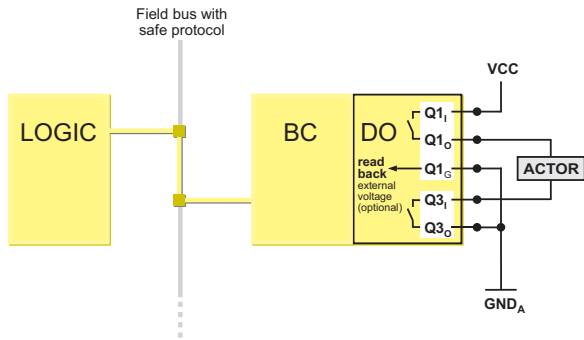
Safety architectures examples with LION



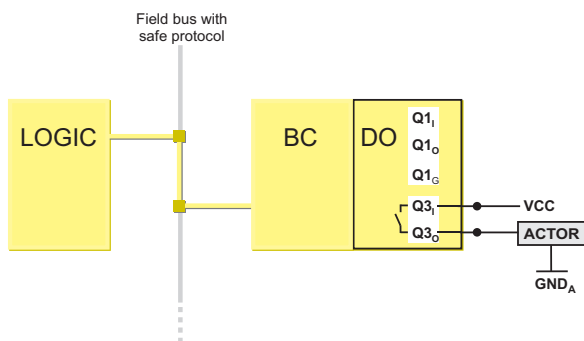
With this architecture pattern, the safety level SIL2* can be achieved. Here the input signal is read in a redundant/antivalent way. The user must ensure that a plausibility inspection of the read in signals is done in the control unit. Two input channels are required for the antivalence. Here all possibilities are open to the user 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 monitored cyclic 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 optional available.



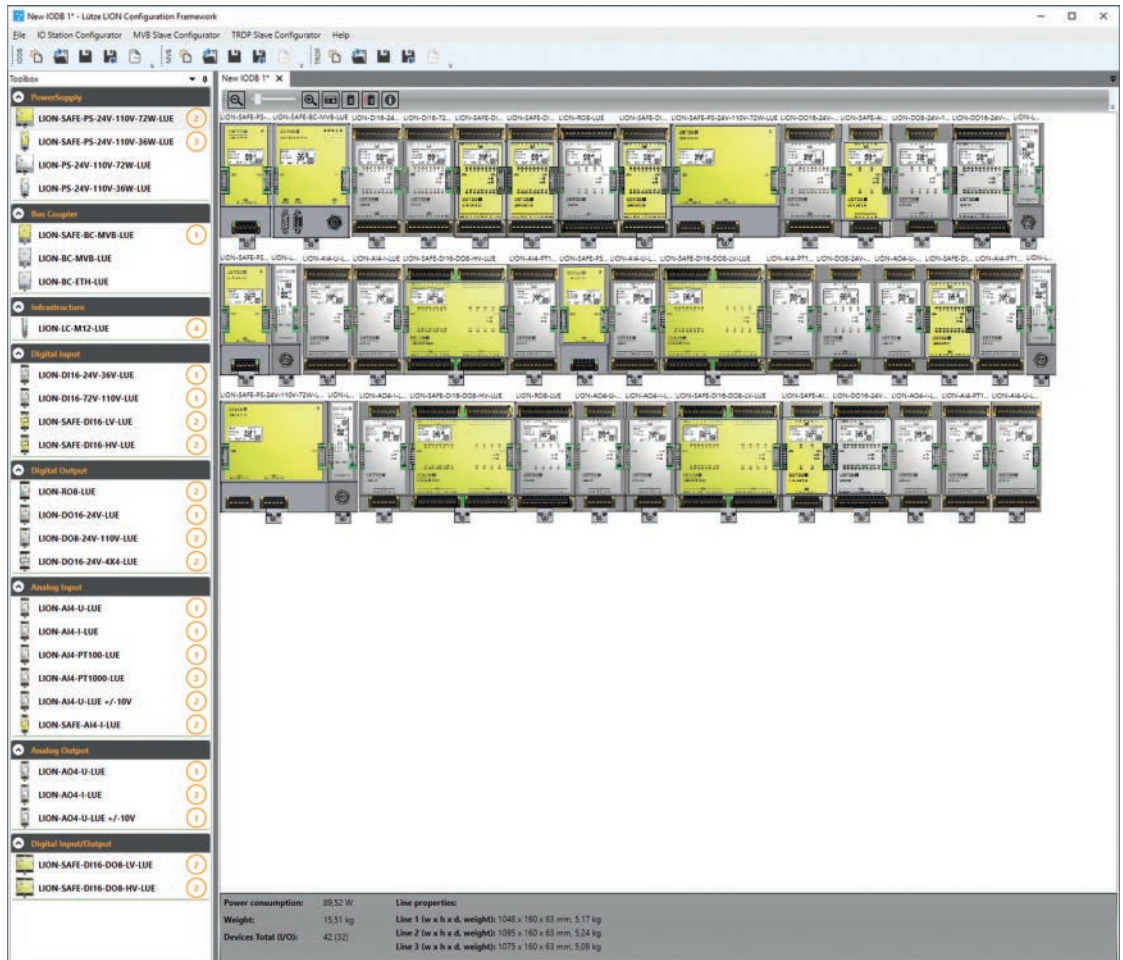
In order to achieve safety level SIL1* it is sufficient to switch the output signal via one channel. Here the outputs are monitored in channel granular manner. The user can read back the current switching condition of the transistor to the internal module monitoring (detection of Stuck-On errors) in 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. (EN50129)

LION - Safety-related TRAIN Control Management System

LION Configuration Framework

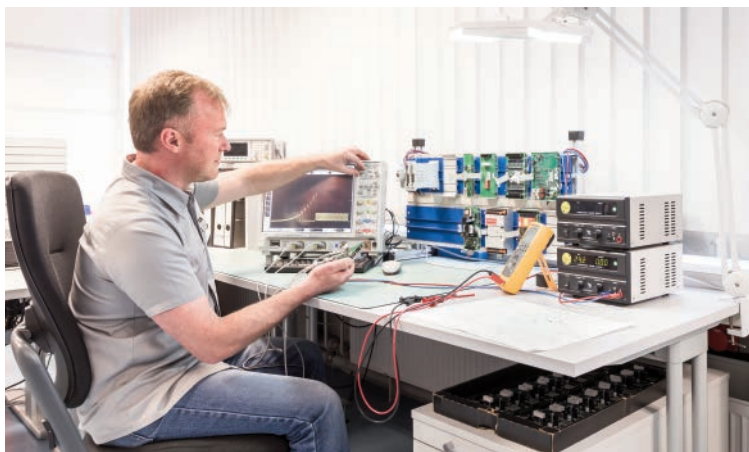
The LION Configuration Framework is an innovative software platform of the LION system. It supports the user during all project phases, starting with the planning of the I/O stations via the field bus configuration right up to the supporting documentation for the safety verification.



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

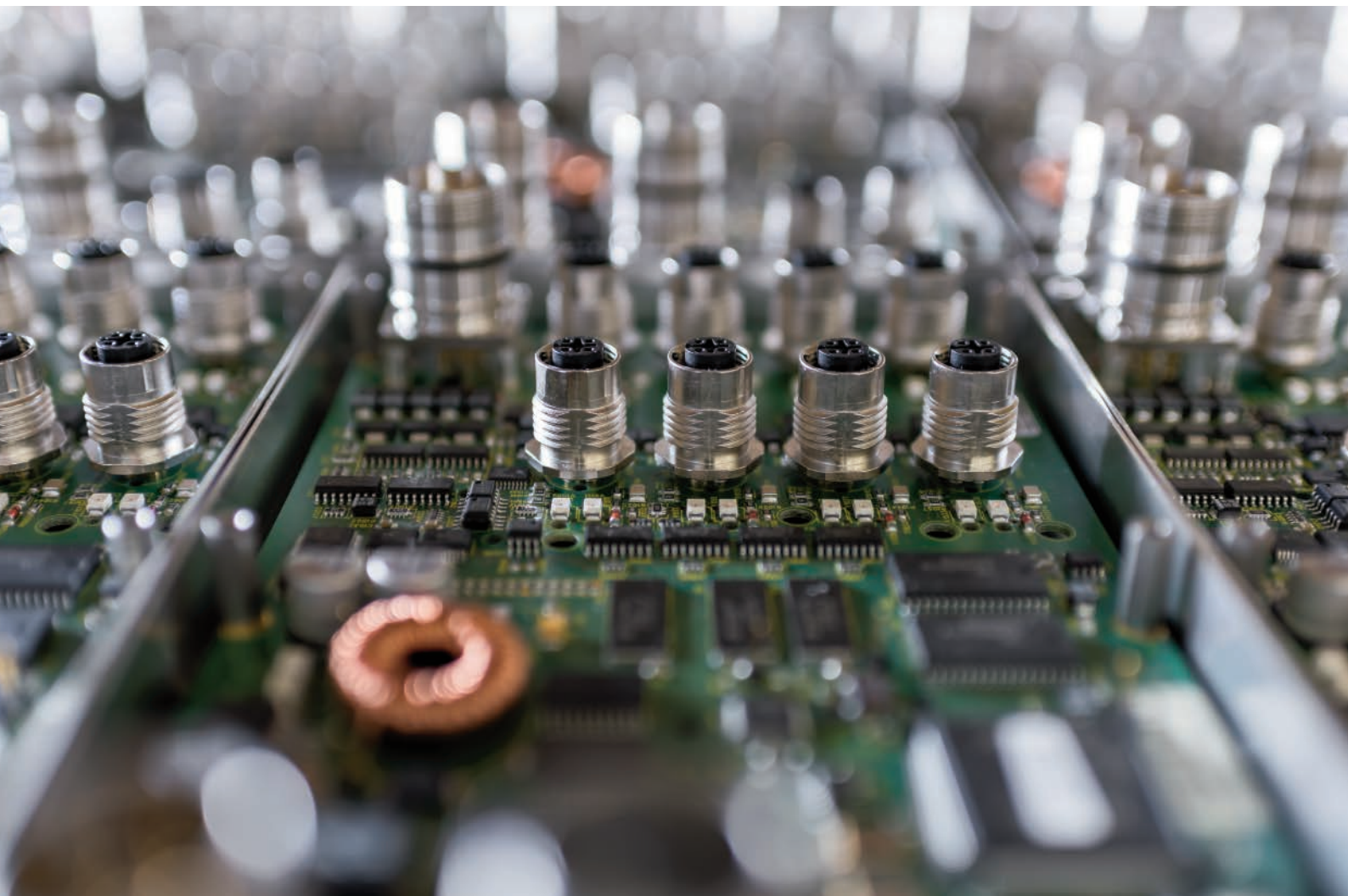
The LION Configuration Framework can be downloaded free of charge under www.luetze-transportation.com.

Railway Technology Competence



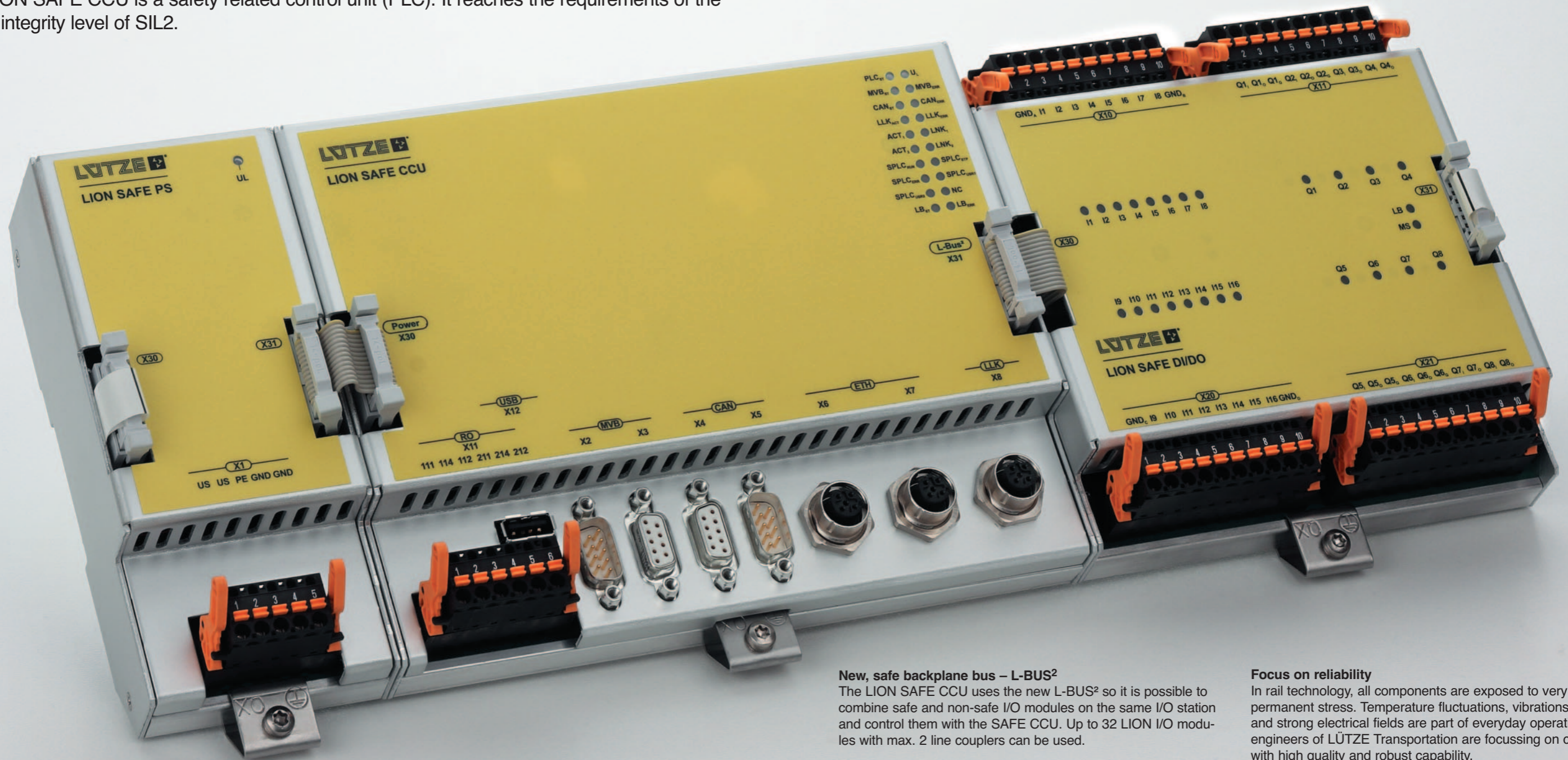
LÜTZE has been developing and manufacturing electrical components for rail vehicles for over 30 years. Our extensive product range of standard components carries out many automation tasks in the most diverse vehicle applications. Are you still looking for the appropriate product adapted to suit your specific application?

Get in touch with us. Our developers help you to find the best solution for your product, 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 signals.



LION - Safe Compact Control Unit

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 has two separated CPU's integrated that communicate with each other. The "Safe CPU" and the "Standard CPU". The Programming of the two CPU's is performed by two independent comfortable IEC61131 software development tools.

Modifications in the Standard CPU are absent of interaction to the Safe CPU. The two CPU's are not influencing each other in hardware or software.

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 starting-up 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.

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 a SDT protocol.

Features

Two relays with positive driven contacts for indication of events or states of the LION SAFE CCU 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 of LÜTZE Transportation are focussing on components with high quality and robust capability.

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 - 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 inside of the same control unit without any cross influences.

Key features

- capable for use as a control unit in safety related applications up to SIL2
- compliant to the standards EN50126, EN50128, EN50129, EN50155, EN50159, EN50121, EN45545
- 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 modified
- time-effective programming phases, saving of development process cost

Technical Data

Part Number 802104 / 802105

CPU

CPU 1	ARM Cortex A8 800 MHz Safe CPU with safe OS, safe scheduler and safe redundant runtime system
CPU 2	ARM netX 500 200MHz standard CPU as communication controller with standard soft-plc runtime system

Communication Interfaces

Fieldbus 1	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 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

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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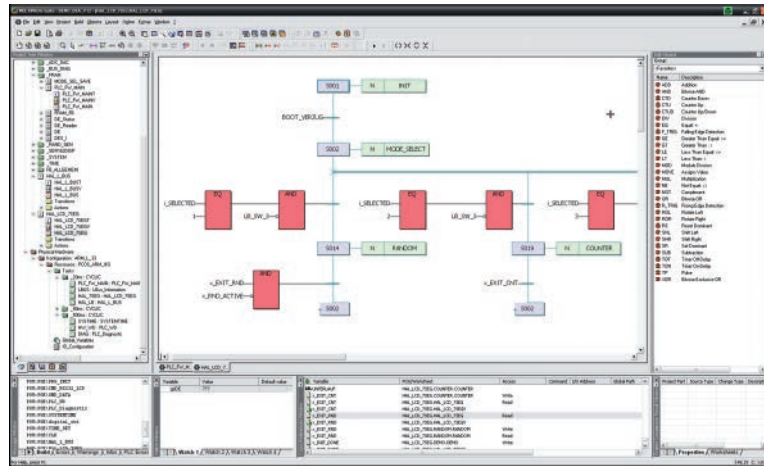
Software

Programming	via Ethernet Interface
Diagnostic	via Web Interface
Safety Programing	
Environment	SafeOS and SafeProg
Standard Programing	
Environment	embedded CLR and Multiprog

Software Engineering Tools

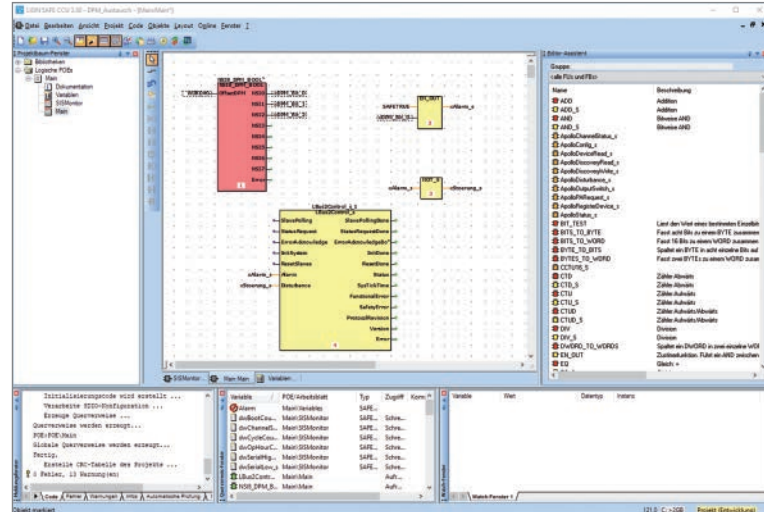
The IEC 61131 PLC programming system MULTIPROG from PHOENIX CONTACT Software GmbH is the central standard engineering component of the LÜTZE PLC controller platform. MULTIPROG accelerates project handling and creation of the PLC application in all programming languages of the IEC 61131.

It supports the integration of fieldbus configuration and diagnostic tools for visualization and parameterization tasks. For this reason it is particularly suited to programming complex networks with distributed control components and also for diagnostics during the starting up and the series operation. High-performance engineering functions such as multi-user operation or automatic project generation enable flexible integration for train manufacturers and operators.



On request, the LÜTZE engineering team can support you to find solutions for your tasks in order to finish your project successfully.

With regard to operation and range of functions, the SAFEPROG safe programming system is specially designed for the requirements of safety applications. SAFEPROG enables you to create your safety application in IEC 61131. Safe programming on the PC is ensured by numerous forward-thinking and error-detecting measures. Clear identification of safe functions and function blocks as well as non-safe variables increases safety.



LION - Safe Compact Control Unit

LION micro PLC



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

Key feature

- capable for use as a control unit in decentralized areas for small applications for example: sanding units, sanitary cubicles, windscreen wipers, compressors, etc.
- compliant to the standards EN50155, EN50121, EN45545, EMV06
- comfortable software development with a free development tool
- high performance, low price

Technical Data

Part Number 802201

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™ soft-PLC: ProConOS eCLR®
Programming	via Ethernet Interface or USB
Programming Environment	embedded CLR and Multiprog Express
Programming Language	languages defined in IEC 61131-3 - FBD, LD, ST, IL, SFC

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



Product Service

CERTIFICATE

No. Z10 18 03 03990 001

Holder of Certificate: Lütze Transportation GmbH

Bruckwiesenstraße 17-19
71384 Weinstadt
GERMANY

Factory(ies):

45345

Certification Mark:



Product:

**Safety related automation systems
LION – Lütze Input Output Network**

Model(s):

**Digital Input / Output Modules (ID900, ID901)
Bus Coupler Module (ID102)
Power Supply Modules (ID200, ID201)**

Parameters:

Safety Integrity Level:	SIL 2 bzw. SSIL 2
Power Supply Modules	
Modul ID200:	DC 24V ... 110V / 72W / 3A
Modul ID201:	DC 24V ... 110V / 36W / 1,5A
Digital Input / Output Modules	
Modul ID900:	DI16 DC 24-36V / DO8 DC 24-110V
Modul ID901:	DI16 DC 72-110V / DO8 DC 24-110V
Bus Coupler Module	
Modul ID102:	MVB EMD, SDTv2
Operating Conditions	
Max. Altitude:	4000m a.s.l.
Ambient Temperature:	Tx
Shock and Vibration:	Cat.1 Class B

Tested according to:

EN 50128:2011
EN 50129:2003
EN 50155:2007
EN 50159:2011
EN 50121-3-2:2015
EN 50124-1:2015

The product was tested on a voluntary basis and complies with the essential requirements. The certification mark shown above can be affixed on the product. It is not permitted to alter the certification mark in any way. In addition the certification holder must not transfer the certificate to third parties. See also notes overleaf.

Test report no.:

FW85257G

Valid until:

2023-03-20

Date, 2018-03-23

(Alfred Beer)



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Certificate

LÜTZE is IRIS / ISO/TS 22163 certified

In 2010, LÜTZE was among the first 25 companies worldwide to obtain the new Railway Industry Standard IRIS certification.

With the transition to the ISO/TS Standard 22163:2017 IRIS goes significantly further than the requirements of the ISO 9001 standard and incorporates additional railway-specific requirements.

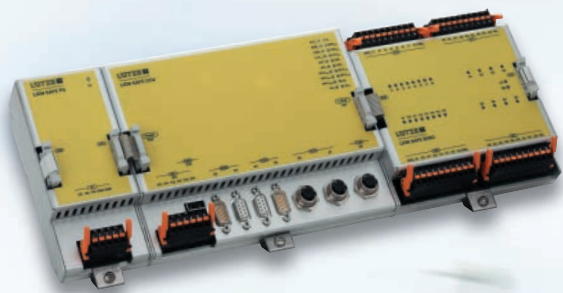


As a specialist for electronic components in rail vehicles, LÜTZE is aware of the high standards that your applications require from our products. Based on this quality awareness and our claim of supporting you with the latest technologies and designing your products reliably and cost-effectively, we have developed into the leading supplier in this market. In addition to the certification according to DIN EN ISO 9001:2000 and as a Q1 supplier of the DB AG, LÜTZE also documents its leading position by means of a certified management system in accordance with the International Railway Industry Standard, IRIS. LÜTZE was one of the first companies worldwide to implement the guidelines of this standard as early as 2006. LÜTZE has also assumed a leading role in the implementation of the significantly more stringent current ISO/TS 22163:2017 and already obtained certification in 2018 for implementing the standard.

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 support you even better in your next projects.

We are on Track!

Electronic control for rail vehicles



Control Technology



Passenger Information



Interface



Indication



www.luetze-transportation.com

LUTZE 
TRANSPORTATION

Germany

Lütze Transportation GmbH
Postfach 12 24 (PLZ 71366)
Bruckwiesenstraße 17-19
D-71384 Weinstadt
Tel.: +49 71 51 6053-545
Fax: +49 71 51 6053-6545
sales.transportation@luetze.de

USA

Lutze Inc.
Tel.: +1 704 504-0222
Fax: +1 704 504-0223

United Kingdom

Lutze Ltd.
Tel.: +44 1827 31333-0
Fax: +44 1827 31333-2

Spain

Lutze S.L.
Tel.: +34 93 2857480
Fax: +34 93 2857481

China

Luetze Trading (Shanghai) Co. Ltd.
Tel.: +86 21 32580670
Fax: +86 21 32580671

www.luetze-transportation.com

