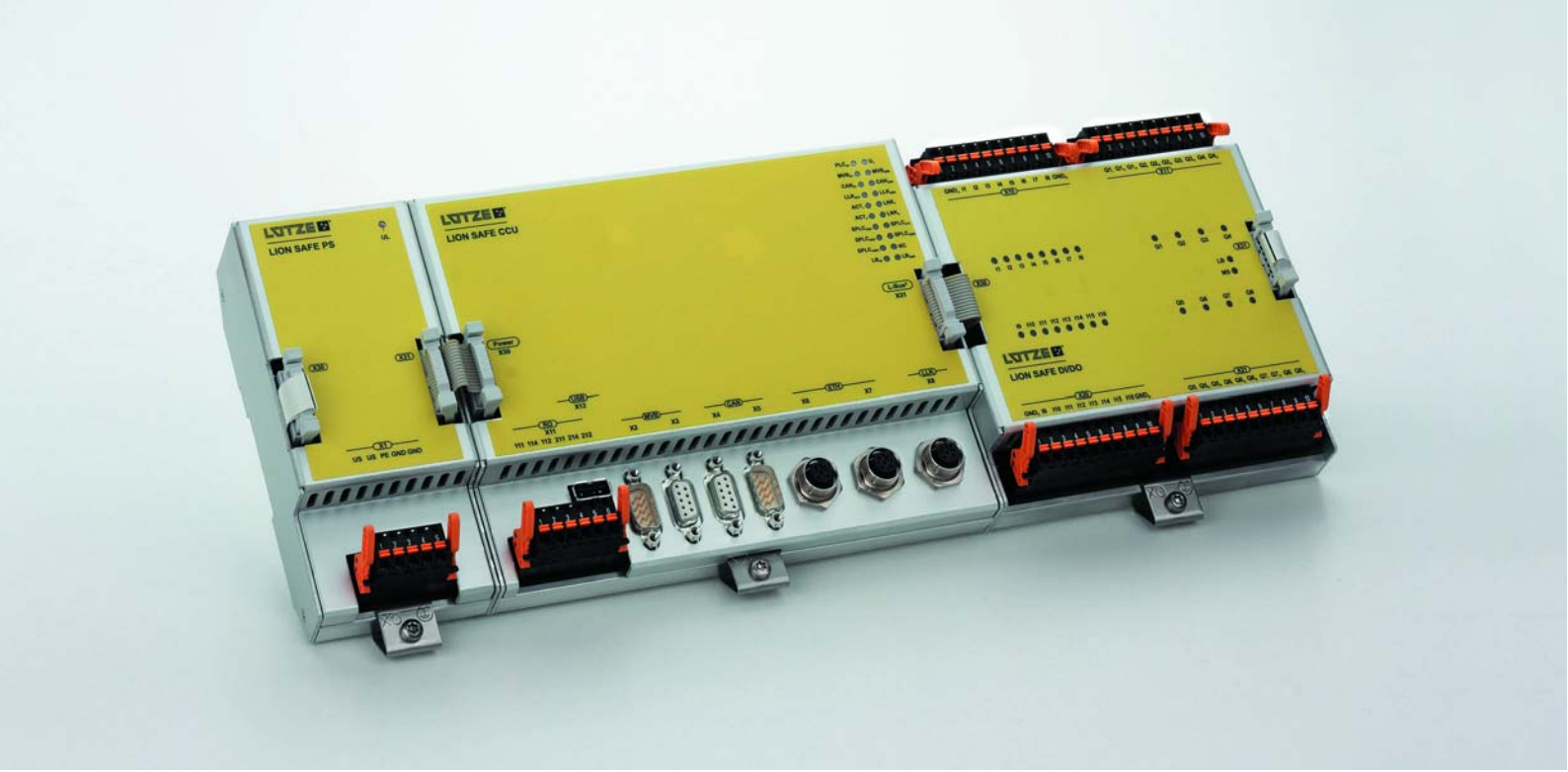


Operating instructions

LION SAFE CCU

Version 07

Content

1 Instruction

These Operating instructions are a part of the LION SAFE CCU. The instructions contain important information about the safety and operation of the devices.

This document contains important information about the use and safety of the following devices:

Artikel-Nr.	Typ	Variant
	LION SAFE CCU (SIL2)	
802106 / 802106.xx	LION-SAFE-PLC-SProg-NFB-NFB-ETH-LLNK-LUE	NFB/NFB*
802107 / 802107.xx	LION-SAFE-PLC-SProg-COS-MVB-ETH-LLNK-LUE	COS/MVB
802108 / 802108.xx	LION-SAFE-PLC-SProg-COM-MVB-ETH-LLNK-LUE	COM/MVB
802109 / 802109.xx	LION-SAFE-PLC-SProg-CAN-MVB-ETH-LLNK-LUE	CAN/MVB

*NFB = No field bus

Before using the unit, carefully read these instructions in order to remove the risk of possible dangers and damage, and to ensure correct use.

Always keep the document available. This applies until the modules have been disposed of. If sold, always pass on the instructions with the device.

2 General information

2.1 Explanation of symbols

The operating instructions contain safety information, which is characterized by a signal word in combination with a certain colour to indicate the warning level. These indicate possible dangers and give instructions on how to avoid them.

DANGER	**Indicates a dangerous situation, which leads to death or serious injuries if not observed.**
WARNING	**Indicates a dangerous situation, which can lead to death or serious injuries if not observed.**
CAUTION	**Indicates a dangerous situation, which can lead to slight or moderate injuries if not observed.**
NOTICE	**Indicates a situation, which could damage the product or the environment. This information foresees injuries.**

	**Indicates technically important information.**
	**Indicates the use of tools.**
SIL relevant	**Indicates a safety-related application condition. These points are given an ID, e.g. LION-0001**

2.2 Copyright

These instructions are intended for the operator and its staff only. The content may not be passed on in full or in part to third parties, reproduced, ecycled or otherwise without written consent of the manufacturer. It is forbidden to give the contents to a third party, to duplicate, exploit or otherwise disclose these in part of or in full, without written permission of the manufacturer. Details, texts, images and drawings in the contents are copyright protected and are subject to commercial property rights. Contravention could result in criminal prosecution. The trademarks and product names mentioned in this document are subject to the trademarks and copyright of the respective registered owners.

2.3 Disclaimer

The instructions have been prepared taking into account the applicable standards, provisions and in accordance with the state of technology. The accuracy of the contents of the documentation has been checked, however deviations cannot be ruled out. No liability is assumed for these deviations. Changes and additions may be recorded in the next version of the operation instructions. The manufacturer does not accept liability for damage or accidents that occur as a result of the following:

- Non-compliance with operating instructions
- When used by untrained or unqualified operatives

- In the case of non-intended use
- If there are unauthorized changes or functional changes to the device
- Usage of non-original or licensed parts or equipment

2.4 Industry standards

Please refer to the respective product data sheet for the exact standard status.

The products were developed in line with the following standards:

- EN 50155, Railway applications - Electronic equipment used on rolling stock
- EN 50121-3-2, Railway applications - Electromagnetic compatibility - Part 3-2: Rolling stock - Apparatus
- EN 61373, Railway applications - Rolling stock equipment - Shock and vibration tests
- EN 50124-1, Railway applications - Insulation coordination - Part 1
- EN 50126, Railway applications - Railway applications - The specification and demonstration of reliability, availability, maintainability and safety (RAMS)
- EN 50128, Railway applications - Communication, signaling and processing systems - Software for railway control and protection systems
- EN 50129, Railway applications - Communications, signaling and processing systems - Safety related electronic systems for signaling

2.5 Abbreviations and terms

Abbreviation / Term	Definition
Apollo Bus	Two-wire bus from the Apollo Fire Detectors Ltd Company.
DPRAM	Dual Ported RAM. RAM memory where read or write accesses are possible at the same time, from two sides.
F-Bus	The Apollo Loop Bus in single- or dual-channel design.
Lütze Link (LLK)/ F-Bus Link (FBL)	Telegram interface from the Host CPU to the F-Bus and L-Bus² peripherals.
F-Bus Module / F-Bus Modem	I/O module with RS485 interface for operating the F-Bus
yellow	Indicates a safety-critical area or safe process
grey	Indicates a safety-uncritical area or safe process
L-Bus² Slave	L-Bus² interface connection, e.g. in an I/O module that on request, communicates with an L-Bus² master.
L-Bus² Gateway	Functional unit for deploying the protocol between F-Bus Link and L-Bus², consisting of an L-Bus² master and an application software that acts as an intermediary between the bus protocols.
LION	Lütze Input Output Network
SafeOS	IEC 61131 runtime system certified in accordance with IEC 61508 up to SIL3, from KW Software
SAFEPROG	Programming system based on the IEC 61131-3 norm. Fulfils the safety requirements defined in IEC 61508.
SIL	**S**afety **I**ntegration **L**evel
SIS	SIL2 Safety control unit

2.6 Identification plate

Note the identification lable.

- The identification plate should always be legible
- If there is a fault, the part number and serial number are needed.

The identification plate, which has the following structure, is located on the LION Safe CCU:

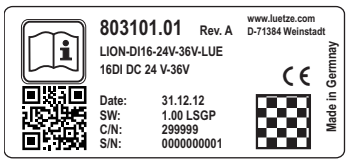


Fig. 1: Example of an identification plate

The identification plate contains the following information:

- Part Number
- Hardware revision
- Module description
- MAC-ID, all other MAC-IDs in the Data Matrix Code
- Production date
- Software version
- Serial number:
- Lot number
- Data Matrix Code, contents: serial number, part number, date, MAC-IDs
- QR-Code, reference to product information

2.6.1 QR-Code – Product information

The QR-code will lead you to additional product information of the manufacturer.

3 Safety

3.1 Other applicable documents

- LION system description
- Operating instructions:

  LION SIL2 I/O modules

  LION I/O modules

  LION infrastructure components
- LION CCU Application Manual

3.2 Content of the operating instructions

The operating instructions must be read before starting work on or with the device and observed accordingly. This applies to all persons who come into contact with the device. Trained personnel and specialists, in particular electricians, who have already worked with similar devices must also read and understand these instructions.

3.3 Appropriate Use

The system has been designed and developed for use on rail vehicles (locomotives, multiple units, underground trains and tramways, etc.).
The safety control unit has been designed for the exchange of data over the safety-relevant LLK with an F-Bus module for example, and to control both non-safe and safe I/O modules over the local L-Bus².
The system can have a maximum of two non-safe field buses that are controlled by the non-safe field bus controller and that can be used to send information to further modules.
The units may only be used for the cases described and only in combination with third-party units and components recommended and authorized by the manufacturer.

If you are unsure and in order to minimise or eliminate risk, you should ask whether the third-party units and components are authorised by the manufacturer.

Appropriate use includes following the instructions in the operation manual.

3.4 Addressees

The operating instructions are directed towards planners, project managers and programmers, as well as staff authorised to commission, operate and maintain the devices and systems. A distinction is made between various qualification levels of the operating staff.

3.5 Operating staff

WARNING

Risk of injury through use by insufficiently qualified operating staff!

Incorrect handling by unqualified or insufficiently qualified staff can lead to material damage and personal injuries.

Activities, which require specific actions, should only be performed by staff trained in advance, or by experts, particularly electricians

A distinction is made in the Operating instructions between the following qualification levels of the operating staff:

Trained staff

The staff have been trained by the operator in the assigned tasks and have been informed of the possible resulting dangers. No technical expertise is required.

Experts

The staff have a technical education, expertise and/or experience in the relevant area and thus are able to perform specific tasks on and with the device.

Electricians

The staff have a technical education in the relevant area and thus are able to perform specific tasks on and with the device.

3.6 Operator's responsibilities

NOTICE

The customer has an obligation to provide feedback if any safety-relevant faults are discovered.

As this device is used in a commercial capacity, the operator must observe the statutory health & safety regulations:

- The operator of the device has a duty to instruct the personnel and be aware of all relevant health & safety regulations.
- The operator must ensure that all health & safety, accident prevention and environmental protection regulations are observed.
- The operator must carry out a risk analysis at the workplace/application site to identify special risks and to warn about these risks.
- These instructions must be available and kept with the device at all times.
- The information in the operating instructions must be followed.
- The device may only be operated if it is in fully working order.

3.7 Protective clothing

No special ESD-protected clothing is required as all devices have been through ESD testing.

3.8 Changes and modifications on the device

WARNING

There is a risk of personal injury and material damage if changes and modifications are made to the module!

Changes and non-authorised modifications to the module can lead to personal injury and material damage.

Do not make changes or modifications to or on the device.

3.9 Safety equipment

DANGER

Risk to life through faults in the overall system!

Faults in the overall system can result from tampering with the modules.

You must ensure that the modules are not accessible to unauthorised persons or unqualified staff.

CAUTION

Electric shocks and material damage through excess voltage at the modules.

Excess voltage at the modules can cause electric shocks if they are touched. The modules can be destroyed by the excess voltage.

Under no circumstances should the protection and safety equipment be circumnavigated or bypassed.

3.9.1 Safety concept

DANGER

Risk to life through faults in the overall system!

Faults can occur in the overall system if the planning of the modules is carried out incorrectly and if the valid standards and regulations pertaining to them are not observed.

All standards and regulations must be observed throughout the planning and execution of the project.
Integrate the safe functions correctly into the primary safety concept.
Test the operation of the system before the final commissioning.

The safety control unit and the F-Bus module can be wired together in any system combination. The safety control unit can also be expanded locally by the addition of safe and non-safe I/O modules on the L-Bus². The maximum number of 4 F-Bus modules can be expanded or other LLK devices can be connected over the LLK Link.

The individual safety control unit represents a generic product pursuant to DIN EN 50129 and is designed for deployment on rail vehicles. In the same way, the F-Bus module was developed as a gateway for the secure connection of F-Bus devices to a primary controller, in accordance with the requirements of DIN EN 50129.

Both SIL0 and SIL2 components can be combined with each other within the safety control unit. The avoidance of feedback between the individual components has been ensured through the isolation concept (primary independence) and the channel separation (secondary independence) on the signal lines.

Additionally, SIL0 components are not capable of creating telegrams including the safety checksum on the L-Bus² or on the LLK.

The safety functions that are implemented through the safety control unit are:

- Secure application and parameter download through SafeProg on the safety control unit.
- The controller safety function that monitors the input, processing and output of process data within a defined maximum cycle time.

3.10 Special safety instructions

SIL relevant

LION-9044

In the concrete installation, the user must ensure that the bit error probability of 10E-5 on the FBL/LLK bus is not exceeded.

According to the reference "Sichere Bussysteme für die Automation*" by Dietmar Reinert & Michael Schäfer, Hüthig Verlag, Heidelberg, Germany, 2001, p. 40, Table 4 - Can a bit error probability of 10E-5 be assumed when using a shielded twisted pair line. *(translated: „Safe bus systems for automation“)

⚠ CAUTION

Electric shocks and material damage through excess voltages.

Electric shocks can result, and the modules can be destroyed if the defined voltage limits are not complied with.

Only deploy approved LION power supply units in the system.
Adhere to the defined voltage limits, as described in the EN 50155 standard.
Do not work with operating voltages outside the prescribed range of
DC 24 – 110 V

NOTICE

Damage to the product by equalising currents.

Disassemble all modules and their connections when carrying out welding.

4 System planning

4.1 Safety integrity level (SIL)

Depending on the usage, the devices can be used in safety-related applications up to SIL2. If the devices are deployed in unsafe environments, they cannot be used as safe components.

SIL relevant

LION-9042 **With respect to the safe state**

During the system project management, attention must be paid to the fact that the safe state of the safety control unit will result in the cancellation of the processing of input and output data, and the interruption of all safe communication interfaces.

4.2 Safety goal

The safety-relevant functions of the safety control unit can be deployed in the application with a safety assurance level (SIL2).

In addition, the hardware has been developed, taking into account the fault-preventing, fault-controlling and organisational measures defined under DIN EN 50129. The corresponding software has also been developed in line with the requirements of DIN EN 50128 SIL2, taking into account the fault-preventing, fault-controlling and organisational measures.

The safety control unit was designed modularly as a generic product. Therefore, the control unit can be expanded as required, through existing L-Bus² and LLK modules. In the implemented application, it is possible to create safety-relevant functions with a Tolerable Hazard Rate (THR) < 10-5/h, which corresponds to SIL2.

4.3 Standards

Please refer to the respective product data sheet for the exact standard status.

The product life cycle and the safety management processes have been implemented in line with the following standards:

- **EN 50126**
  Railway applications - The specification and demonstration of reliability, availability, maintainability and safety (RAMS)
- **EN 50128**
  Railway applications Communication, indication and processing systems - Software for railway control and protection systems
- **EN 50129**
  Railway applications Communication, indication and processing systems - Safety related electronic systems for signaling

Category 2, SIL2, applies to the devices described here:

- The device hardware has been developed to be fully compliant with EN 50129 SIL2.
- The software modules on the devices have been developed to be fully compliant with EN 50128 SIL2 in respect of the described processes and fault-preventing measures.

System approval

The LION SAFE CCU devices described here and 3000+ SAFE FBUS MODULE are certified as a system. The system integrator or rail vehicle manufacturer can use the certification for their own approval.

The system is approved by TÜV Süd Rail.

4.4 Hazard Rate (HR)

To be compliant with EN 50129, the THR of a SIL2 system has to be as follows:

$10^{-7} \leq THR \leq 10^{-6}$

The proof of the quantitative safety goals is achieved with the help of a fault tree analysis and in accordance with IEC 61709 (SN29500).

A mid-range temperature profile with an ambient temperature +45°C was selected as the component ambient temperature. The operating time is calculated as 360 x 20 hour days.

The following results have been taken from the hazard analysis:

4.4.1 Safety control unit HR

The safety goal of using a maximum of 30% of the approved HR for SIL2 was set for the system.

The calculated HR for using all the safety control unit's functions is $2.75*10^{-7}$.

Thus, with the calculated fault rate, the safety control unit falls within the permitted range for SIL2.

4.5 Definition of cycle time, reaction time and maximum reaction time

Case 1: L-Bus² with LION I/O modules

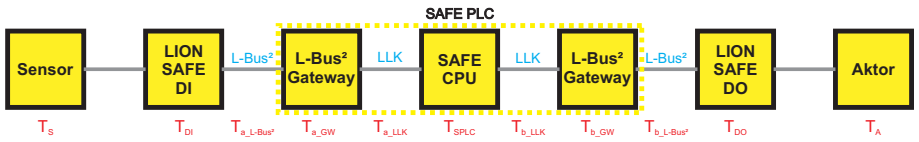


Fig. 2: Chain for the determination of the maximum system reaction time on the L-Bus²

Case 2: FBL (LLK) with F-Bus modules

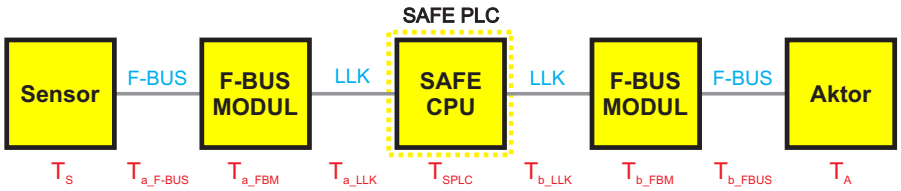


Fig. 3: Chain for the determination of the maximum system reaction time on the F-Bus

Further technical details are described in the F-Bus module Operating instructions

The system components shown above each have a cycle time. The cycle time describes the internal processing time of each component.

Description	Time	Comment
T_S	Variable	Dependent on the deployed sensor
T_{DI}	2 ms	Time for hardware and software of a DI in the LION SAFE DI/DO module
T_{x_GW}	0.7 ms	L-Bus² Gateway cycle time
T_{SPLC}	Variable	Safety control unit main task cycle time (minimum SAFE PLC cycle time is 5 ms)
T_{x_FBM}	2 ms	F-Bus module cycle time
T_{DO}	4 ms	Time for hardware and software of a DO in the LION SAFE DI/DO module
T_A	Variable	Dependent on the deployed actuator

The components shown above communicate over internal field buses. In respect of communication cycle times, the following times have to be taken into account

Description	Time	Comment
$T_{x\_L\text{-}Bus²}$	Variable	The L-Bus² transfer time is dependent on the type and quantity of connected LION I/O modules. The user should request the calculation program from the manufacturer for calculating this time. Example: When using only one LION SAFE DI/DO module on the L-Bus², the L-Bus² transfer time is 0.25 ms.
T_{x_LLK} for the L-Bus² Gateway	Variable	**L-Bus² Gateway cycle time** *0.7 ms* **L-Bus² Gateway telegram size** *((Total of all L-Bus modules) * (Total data from the queried slave))) Module 64 +1) * 12 Byte*
T_{x_LLK} for the FBUS module	Variable	**Calculation formula:** *Min. PLC execution time +* *(LLK_Telegram size*LLK_Transfer rate)* *+ (LLK Task reaction time * Number of clients)* **LLK _Telegram size** *20 bytes + n * Channel images* *(n = number of used F-Bus channels)* **LLK Transfer rate** *3µs/Byte* **LLK task reaction time** *1 ms* **Channel images telegram size** *15 bytes + m * Device images* *(m = Number of F-Bus devices on the loop)* **Device images** *17 bytes*

$T_{x\_F\text{-}BUS}$	Variable	**Calculation formula:** *Polling time data +* *HWT time +* *Bus cycle time* **Polling time data** (tBus Pause + Number of detectors * tDetectors) **HWT time** *(Polling time data / 500) * tHWT* **TBuscycle** *Polling time data + HWT time + tCycle FBM* **tBus Pause** *150 ms* **tDetectors** *45 ms per detector* **tHWT** *10 ms (every 500 ms)* **tCycle FBM** *2 ms*

4.5.1 Cycle time

Cyclical operation in the safety control unit (SAFE PLC)

Description	Time	Comment
Minimum watchdog time SAFE PLC	3 ms	--
Minimum SAFE PLC cycle time	5 ms	>= Watchdog time +2ms
Maximum SAFE PLC cycle time	1300 ms	Causes the watchdog to trigger at a restart
Minimum SAFE PLC program execution time	0.5 ms	Measurement with minimum program
Intelligent watchdog monitor - timeout	30 ms	External µC that the safe CPU monitors
LLK/FBL task reaction time	1 ms	

NOTICE

The monitor module from the SIL control unit can be used to determine the cycle time. This defines the currently required cycle time and the maximum cycle time. The online Help has instructions on this topic.

4.5.2 Process safety time

Safety control unit reaction time for identifying internal faults (SAFE PLC)

Description	Time	Comment
Max. reaction time for identifying MMU faults	Variable	PLC cycle time + 2 (min. 10 ms)
Max. reaction time for identifying CPU faults	2 seconds	
Max. reaction time for identifying stack faults	2 seconds	
Reaction time for identifying firmware CRC fault	8 minutes	
Reaction time for identifying RAM faults	8 minutes	
Reaction time for identifying IEC CRC faults	Variable	Calculation formula: Application size in bytes / 256 / 2 * PLC cycle time

4.5.3 System reaction time

The system reaction time results from the chaining of the individual cycle times.

Case 1: L-Bus² with LION I/O modules

$T_{Reaction} = T_S + T_{DI} + T_{a\_L\text{-}Bus²} + T_{a\_GW} + T_{a\_LLK} + T_{SPLC} + T_{b\_LLK} + T_{b\_GW} + T_{a\_L\text{-}Bus²} + T_{DO} + T_A$

Case 2: LLK with F-Bus modules

$T_{Reaction} = T_S + T_{a\_FBUS} + T_{a\_FBM} + T_{a\_LLK} + T_{SPLC} + T_{b\_LLK} + T_{b\_FBM} + T_{a\_FBUS} + T_A$

5 Transport and storage

NOTICE

- **Product damage caused by exposure to damp.**
  Store the products in a dry atmosphere between -40 and 85°C.
- **Product damage caused by insecure packaging.**
  The product should be packed securely for transportation in order to absorb the effects of any impacts.
- **Product damage caused by dust.**
  The product's printed circuit boards are lacquered. However you should ensure a dust-free environment, in order to avoid possible damage.
- **Product damage caused by electrostatic discharge.**
  Electronic components should only be stored and transported in an ESD-secure environment and in special packaging.

5.1 Delivery scope

- 1 x LION SAFE CCU
- 1 x Instruction leaflet
- 1 x L-Bus² bus termination plug
- 1 x L-Bus² 1:1 cable
- 1 x Push-in 6-pin connector
- 1 x Connector coding station
- 1 x Connecting tank coding station

6 Installation and assembly

CAUTION

Risk of injury and material damage by electric current.

The effects of electric currents can cause personal injury and destroy the modules.

Disconnect the system from the power supply before assembly or disassembly.

The modules must be installed and assembled by qualified personnel.

SIL relevant

LION-9014

The system's install location must be suitable for devices with IP20 protection rating.

6.1 Installation positions

The modules must be mounted on a TS35 hat profile rail. The following installation positions are permitted:

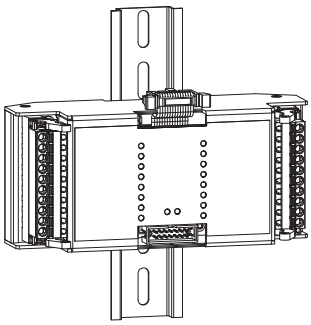


Fig. 4: Installation position - vertical

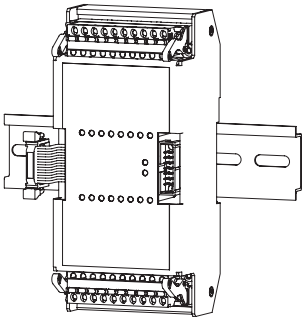


Fig. 6: Installation position - horizontal

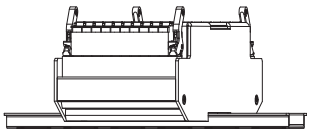


Fig. 5: Installation position - laying flat

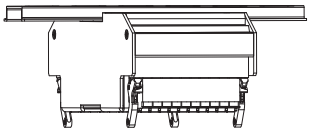


Fig. 7: Installation position - overhead

6.2 Installation space

More space is needed for cabling. The values given below correspond to the minimum values.

- **Above**
  5 mm
- **Below**
  Without ground connection: 5 mm
  With ground connection: 20 mm
- **Side**
  0 mm

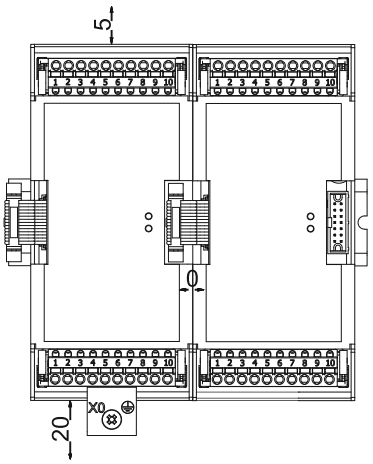


Fig. 8: Mounting distance

6.3 DIN rail mounting

- The device can be mounted and dismounted up to 100 times.
- Use the hat profile rail end-piece on the sides of the equipment.

1. Hook the module into the lower edge of the hat profile rail.
2. Push the device slightly upwards.

Push the device down so that it locks onto the hat profile rail.

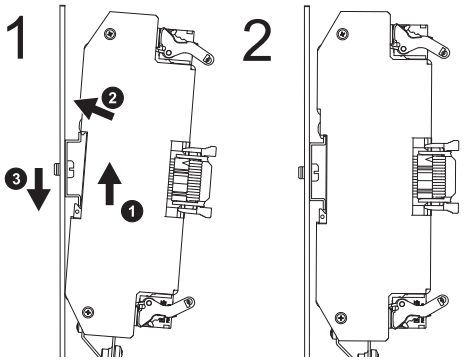


Fig. 9: Mounting

6.4 Dismounting

Each device can be dismounted separately from the hat profile rail.

1. Push the device slightly upwards.
2. Push the device upwards so that it releases itself from the hat profile rail.
3. Lift the module off the hat profile rail.

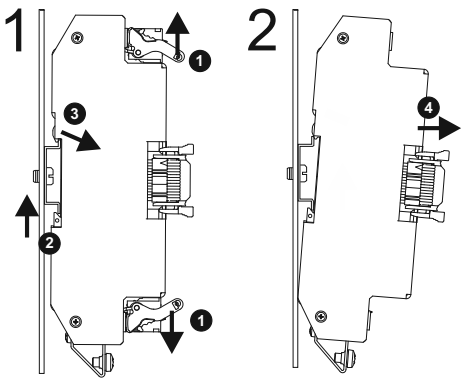


Fig. 10: Dismantling

6.5 Grounds

WARNING

Electric shocks and injuries through incorrect grounding.

- The devices must be grounded by a qualified electrician.
- The ground connection must not be more than 20 cm long. 10 cm is recommended.
- The ground cable must have a gauge of at least 2.5 mm².
- The cable shoe used must be as wide as possible.
- Always ground the device via the PE connection (X0 clamp), not the DIN rail.
- Ground the DIN rail separately in order to comply with the EMC Directive.

Connect the ground cable to the X0 connector of the DEVICEs:

1. Loose the screw **(3)*** of the PE connection *(X0 clamp)*.
2. Use a circular cable shoe on the earth cable **(2)**.
3. Fix the circular cable shoe between the safety washer **(1)** *(e.g., "Schnorr washer", etc.)* and the screw **(3)**.
4. Ground the module.

** screw with hexalobular internal socket (e.g., "TX", "6-lobe", "star screw", etc.)*

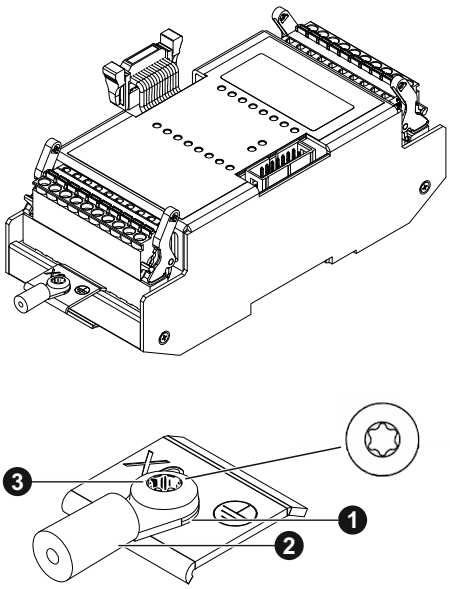


Fig. 11: Grounds

NOTICE

Protection against EMC influences

The module PE connection must be as short as possible and connected to ground potential with the lowest possible inductance.
For modules with several earthing points (e.g., power supply plug and module PE connection), only one contact needs to be connected.

We suggest a maximum length of 1 m. Grounding must be star-shaped.
The mounting plate forms the star point. Up to 5 m were tested for function by Lütze Transportation GmbH. However, please consider the possible EMC effects. In EMC critical areas we recommend a short length of 10 cm.

For further information please contact the Lütze Transportation GmbH.

Screw specifications: Galvanized screw, lens, TX20, M4x8
Tightening torque: 1.8 Nm ... 2.0 Nm.

6.6 Wiring

The modules have corresponding interfaces with push-in terminal blocks. White numerals are printed on the terminal blocks, starting from 1.

Technical data - Push-in plug-in terminals

Pin spacing (RM)	5.8 mm
Rated current	12 A
Color	black
Conductor	0.2 – 2.5 mm^2 / AWG min 24, max 12
Strip length	10 mm
Protection	against

Maximum length of the cable

- In line with the EMC guidelines, the maximum length of the cable should not exceed 50 m.
- The terminal blocks must be plugged in at all times for the module to achieve the IP20 protection rating.

A 3.5 x 0.6 mm screwdriver will be needed for the wiring.

1. Press the orange slots down with the screwdriver.
   While doing this, insert the cable into the corresponding pins.
2. Remove the screwdriver.

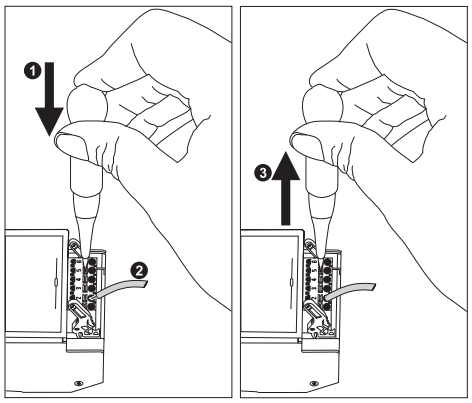


Fig. 12: Wiring

6.7 Terminal block coding

The terminal blocks can be coded. Corresponding coding elements are included in the delivery. The coding can help to prevent reverse polarity.

This allows you to realize a key-lock principle:

1. e.g., push in the coding pin (Type A) for the terminal.
2. e.g., push in the coding pin (Type B) at the other pins on the terminal connector.

The locking and releasing of the terminals is described below.

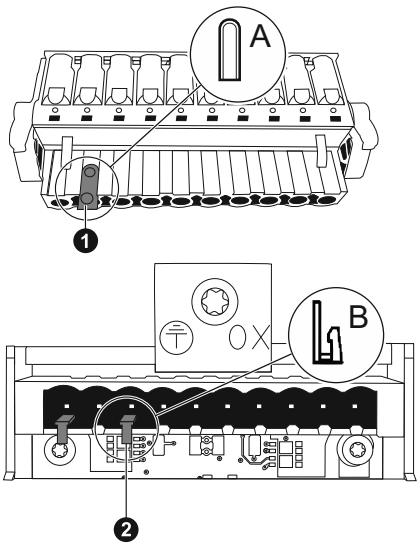


Fig. 13: Coding the plug-in terminals

6.7.1 Positioning the push-in terminal blocks

1. Locate the lug in the plug-in terminal.
2. Push the lug down.
   The terminal block is in place.

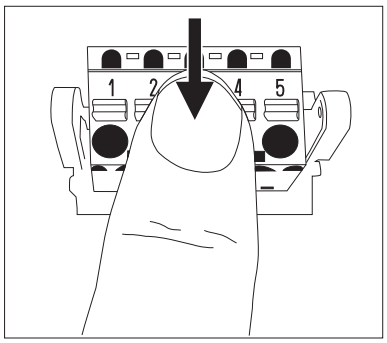


Fig. 14: Positioning the push-in terminal blocks

6.7.2 Loosening the push-in terminal blocks

1. Pull the lever forwards or push it backwards, depending on the installation.
2. Pull the terminal block upwards.

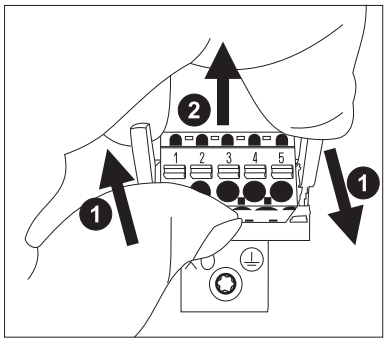


Fig. 15: Loosening the push-in terminal blocks

6.8 Connecting the I/O modules

CAUTION

Risk of injury and material damage by electric current.

The effects of electric currents can cause personal injury and destroy the modules.

Disconnect the system from the power supply before assembly or disassembly.

SIL relevant

LION-9011

Through the mandatory wiring check, the safety programmer must additionally ensure that a corresponding signal is connected to the right terminal on the right device.

With the LION system, I/O modules are connected to the system's safety control unit though the L-Bus².
Please proceed as follows:

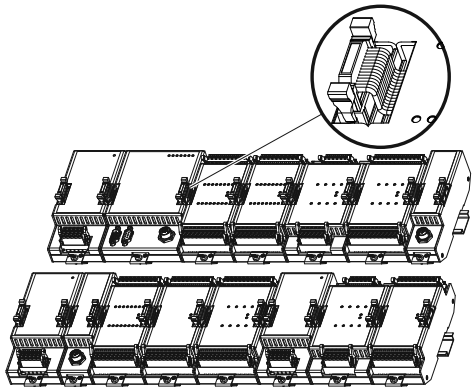
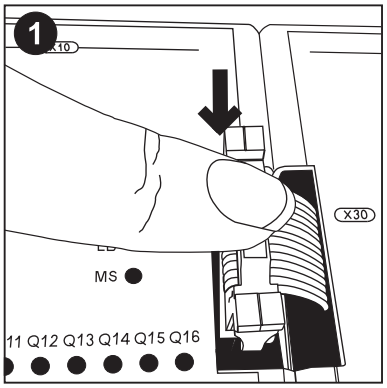


Fig. 16: LION System

Technical data - L-Bus² interface

Insertion cycles	500
Contacts	14
Protection	against reverse polarity

1. Connect the L-Bus² connector to the neighboring device.



2. Press the locking nose down so that the cable locks in securely.

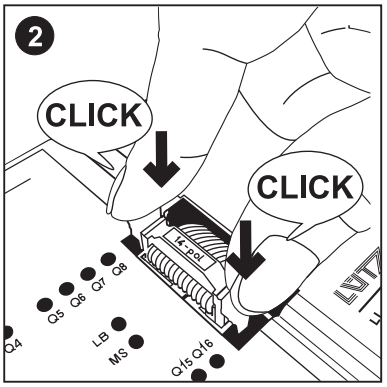


Fig. 17: L-Bus² - Module connection

6.9 Loosening the module connection

1. Press on the side of the connection nose.
2. Pull the cable up.

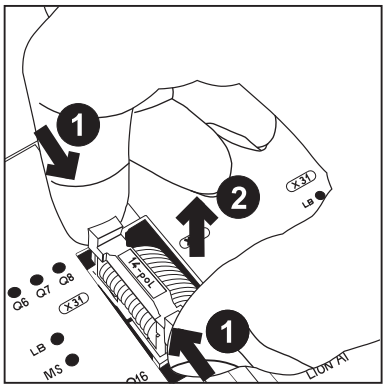


Fig. 18: L-Bus² - Loosen the module connection

6.10 System termination

6.10.1 Bus termination plug

The termination plug is included in the delivery
(Part no. 800201).

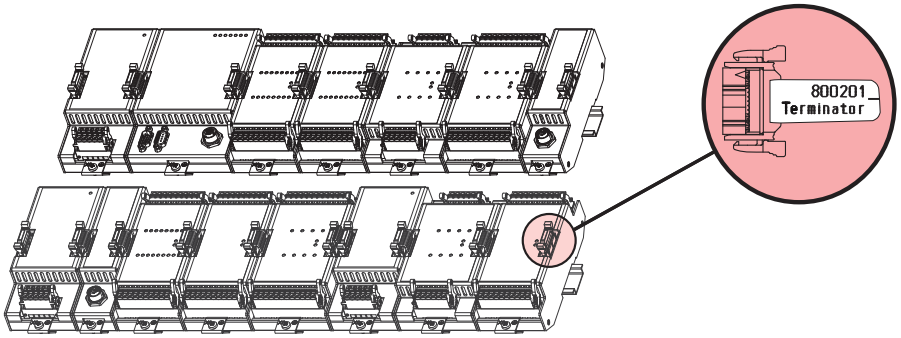


Fig. 19: LION System termination

SIL relevant

LION-9027 The termination plug must be plugged in on the last module on the L-Bus².

The termination plug has the following functions:

- Activation of the bus resistor
- Terminating the address bus (left to right)
- Activation of the "Termination plug exists" signal.

6.10.2 Bus dummy connector

The dummy connector is included with the power supply. (Part no. 800202).

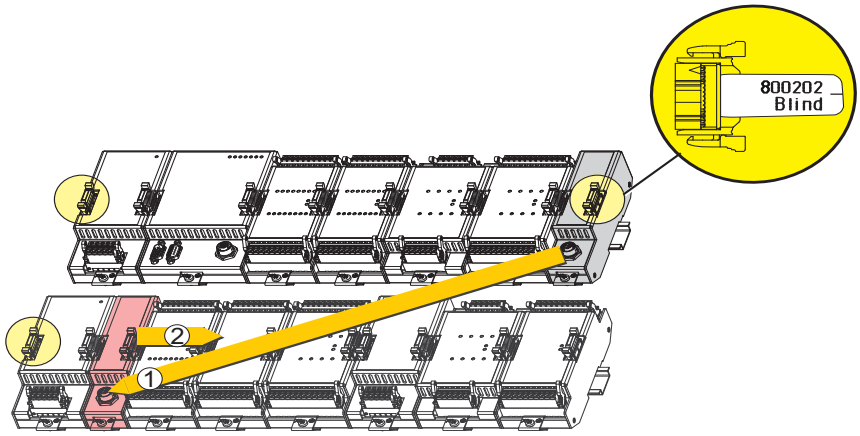


Fig. 20: LION system - Dummy connector

The dummy connector must be plugged in at the start of each line in each module with free L-Bus².

7 Product structure

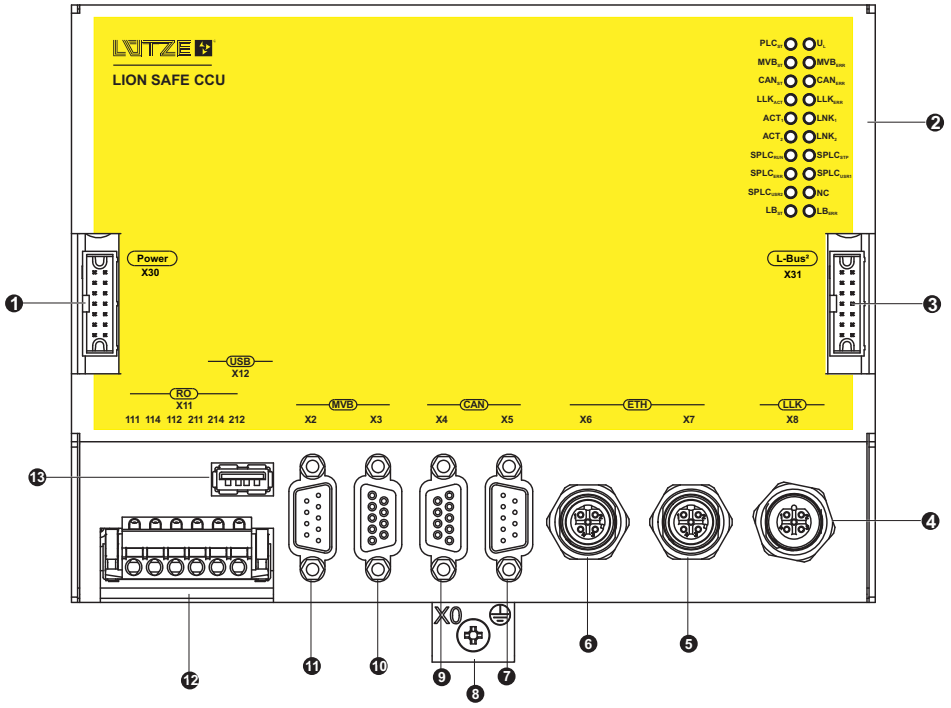
SIL relevant

LION-9016 **The system's technical specifications are described in this chapter.**

The LION SAFE CCU safety control unit is a safety-related PLC. It fulfils the standards required of a SIL2 risk reduction level.

The control unit has a Lütze Link Interface (LLK) for the connection of external modules. Using this for example, an L-Bus² Gateway can be attached internally to expand the control unit through the addition of safe and non-safe local I/O modules. In addition, devices like an F-Bus Loop Gateway for example, can be connected over the LLK.

A grey, non-safety-related PLC is also integrated in the safety control unit. The deployed controller is used to create the non-safety-related field buses MVB and CAN. The controller is connected to the Safe CPU over a multiplexed data and address bus. There is sufficient channel separation on the data interface to exclude mutual interference.



1	L-Bus² inbound X30
2	Status LEDs
3	L-Bus² outbound X31
4	FBUS-Link LLK X8
5	Ethernet #2 X7
6	Ethernet #1 X6
7	CAN outbound X5
8	PE connection X0
9	CAN inbound X4
10	MVB outbound X3
11	MVB inbound X2
12	Relay outputs X11
13	USB connection X12

7.1 Technical specifications

7.1.1 Standard processor core

Controller	CPU	ARM926 200 MHz 32 Bit
	Program memory	4 MB Flash
	Memory for remanent data	4 KB FRAM
	Working memory	32 MB SD RAM
	Diagnostics memory	2 MB Flash
	Realtime clock (RTC)	1 Real Time Clock without battery buffering
Software	Operating System	Realtime operating system rcX Soft PLC KW ProConOS® software
	Runtime system Programming languages	In accordance with IEC 61131-3: AWL, KOP, FBS, ST, AS
	Programming system	MULTIPROG®
	Field bus configuration visualization	Flexible over configurator or over FB (OPC (Ethernet))

7.1.2 Safety processor core

Controller	CPU	SITARA AM4379 (Cortex A) A9 1Ghz
	Program memory	1 MB
	Working memory	4 MB
	Diagnostics memory	8 KB
	Realtime clock (RTC)	1 Real Time Clock without battery buffering
Software	Bootloader	Technical specifications are missing
	Operating System	FreeRTOS
	Runtime system	SAFEOS®
	Programming languages	FBS, ST
	Programming system	SAFEPROG®

7.1.3 Peripherals

Possible bus systems	CAN	CANopen Master
		CANopen Slave
		CAN2.0
	MVB	MVB EMD Slave Class 1.3
	Ethernet	Ethernet TCP/IP client or server
		Ethernet UDP/IP client or server
		MODBUS TCP/IP client or server
Local safe buses	L-Bus²	For connecting safe and non-safe LION I/O modules to the device
	LLK/FBL	For connecting proprietary safe Gateways, e.g. the 3000+ SAFE FBUS module
Miscellaneous	USB	No function
Relay outputs	Number	2
	Connection device	Spring terminal on X12
	Contact type	Forcibly guided in accordance with EN 50205 application type A
	Style	Changeover contacts
	Contact material	AgCuNi + 0.2 µm Au
	Switch-on delay	approx. 18.5 ms
	Switch-off delay	approx. 21 ms
	Mechanical service life	Approx. 10 x 10^6 switching cycles
	Switching voltage	AC/DC 5…250V
	Switching current	AC/DC 0.005…6 A

7.1.4 Other characteristics

Supply voltage	DC 24V over LION PS
Current Consumption	Max. 3.4A, consisting of: 0.6A own consumption 1.0A over L-Bus² 1.8A over LLK/FBL
Dimension (LxWxD)	192 x 160 x 60 mm
Weight (kg/St.)	0.8 kg
Protection class	IP20
Mounting type	DIN rail mounting
Operating temperature	-40°C to +70°C (+85°C for 10 min.)?corresponds to EN 50155 category TX
Storage temperature	-40 °C to +85 °C
Potential groups and isolating voltage	AC 500 V ethernet and electronics AC 500 V MVB and electronics AC 500 V CAN and electronics AC 500 V LLK/FBL and electronics AC 500V SafeRelay and electronics

7.2 LED description

7.2.1 Safety control unit (SPLC) LEDs

LED						Meaning
					System start	
U_L	SP-C_{RUN}	SPL_{STP}	SP-C_{ERR}	SP-C_{USR1}	SP-C_{USR2}	
●	●	●	●	●	●	All the safety control unit LEDs are switched on together for at least 100 ms at start-up as a function test.
	Operating mode ON					
●	○	○	○	○	○	The safety control unit has been activated. The **U_L** LED is on.
	Operating mode LOADING					
●/○	○	○	○	○	○	The safety control unit is loading a program. The **U_L** LED flashes in a 250 ms rhythm.
	Operating mode SAFE RUN					
●	●/○	○	○	○	○	The safety control unit program is being executed. The $SPLC_{RUN}$ LED flashes in a 500 ms rhythm. The **U_L** LED is on.
	Operating mode DEBUG RUN					
●	●/○	○	○	○	○	The safety control unit program is being executed in Debug mode. The $SPLC_{RUN}$ LED flashes in a 250 ms rhythm. The **U_L** LED is on.
	Operating mode SAFE STOP					
●	○	●	○	○	○	The safety control unit program has been paused or no program is being executed. The **$SPLC_{STP}$** LED is on. The **U_L** LED is on.
	Operating mode DEBUG HALT					
●	●/○	●/○	○	○	○	The safety control unit program has been paused in Debug mode. The **$SPLC_{RUN}$** and **$SPLC_{STP}$** LEDs flash in a 250 ms rhythm. The **U_L** LED is on.
	Operating mode DEBUG STOP					
●	○	●/○	○	○	○	The safety control unit program has been stopped in Debug mode. The **$SPLC_{STP}$** LED flashes in a 250 ms rhythm. The **U_L** LED is on.
	PLC operating mode undefined					
○	○	○	○	○	○	The safety control unit has entered an undefined mode. All LEDs are off.

LED	Meaning
Controllable error state	
	The safety control unit is in a controllable error state, e.g. a bus timeout occurred. The safety control unit can be restarted through SAFEPROG. The **$SPLC_{ERR}$** LED flashes every second. All other LEDs are switched dependent on the operating mode.
Non-controllable error state	
	The safety control unit is in an error state. The error is non-controllable, e.g. a task ended unexpectedly or an exception error has occurred. The error LED flashes in a 250 ms rhythm or faster. All other LEDs are switched off.

7.2.2 LLK/FBL interface LEDs

LED		Meaning
System start		
LLK_{ST}/ FBL_{ST}	**LLK_{ERR}/ FBL_{ERR}**	
		Both LEDs are switched on together for at least 100 ms at start-up. This serves as a function test.
Operating mode		
		Both LEDs are off after start-up.
 /		The **LLK_{ST}/FBL_{ST}** LED flashes for 100 ms each time a telegram is correctly received.
	 /	The **LLK_{ERR}/FBL_{ERR}** LED flashes for 100 ms if the CRC check carried out on the received telegram reports a faulty telegram or another receive error is present.
Non-controllable error state		
	 /	The error LED flashes in a 250 ms rhythm or faster. The **LLK_{ST}/FBL_{ST}** LED is off.

7.2.3 L-Bus² LED

LED		Meaning
LB_{ST}	LB_{ERR}	
		Initialization/Addressing
○	○	Initialization of the L-Bus² CPU and the local module peripherals, execution of self-tests and addressing the L-Bus² slave.
		Configuration
● / ○		Green LED flashes slowly (2 Hz). Configuration phase including checking the L-Bus² topology and receipt of the configuration data. No process data communication on the L-Bus².
		Normal operation
●	○	Error-free operation with cyclical communication on the L-Bus², sending and receiving process data from all L-Bus² slaves
		Limited run
○	● /	Red LED flashes slowly (2 Hz) Limited operation with cyclical communication on the L-Bus², sending and receiving process data from error-free L-Bus² slaves.
		Safe state L-Bus² peripherals
○	● / ○	Red LED flashes quickly (5 Hz + pause). No process data communication on the L-Bus², safe status of the process peripherals. Communication still present on the F-Bus Link.
		Failsafe
○	○	Adoption of safe state if a non-controllable error occurs. Shut down process data communication on the L-Bus² and F-Bus Link.

7.2.4 LED on the MVB field bus

LED	Color	Condition	Description
MVB_{ST}	●	Permanently on	Freely programmable by the user
		Flashing	
		Permanently off	
MVB_{ERR}	●	Permanently on	Freely programmable by the user
		Flashing	
		Permanently off	

7.2.5 LED on the CAN field bus

LED	Color	Condition	Description
CAN_{ST}	●	Flashes once	Stop mode
		Flashing	Pre-operation mode
		Permanently on	Operating mode
CAN_{ERR}	●	Flashes once	At least one of the CAN controller error counters has reached the warning threshold
		Flashes twice	Error monitoring or heartbeat event.
		Permanently on	CAN controller in "bus off" mode

7.2.6 LED on the Ethernet field bus

LED	Color	Condition	Description
LNK_1/ LNK_2	●	Permanently on	Ethernet connection OK
		Permanently off	Ethernet connection faulty
ACT_1/ ACT_2	●	Flashing	Ethernet data transfer
		Permanently off	No Ethernet data transfer

7.3 Interface description

7.3.1 Relay outputs X11

Pin	Signal	Description
111	CO_1	Relay 1, switch-over contact
114	NO_1	Relay 1, N/O contact
112	NC_1	Relay 1, NC contact
211	CO_2	Relay 2, switch-over contact
214	NO_2	Relay 2, N/O contact
212	NC_2	Relay 2, NC contact

7.3.2 MVB interface X2 and X3

Pin	Signal	Description
1	AP	A.DATA_P
2	AN	A.DATA_N
3	res	reserved
4	BP	B.DATA_P
5	BN	B.DATA_N
6	RAP	A.TERM_P
7	RAN	A.TERM_N
8	RBP	B.TERM_P
9	RBN	B.TERM_N

7.3.3 CAN interface X4 and X5

Pin	Signal	Description
1	--	Not connected
2	CAN-L	CAN Low
3	GND	CAN GND
4	--	Not connected
5	--	Not connected
6	--	Not connected
7	CAN-H	CAN High
8	--	Not connected
9	--	Not connected

7.3.4 Ethernet interface X6 and X7

Pin	Signal	Description
1	Tx+	Transmit data positive
2	Rx+	Receive data positive
3	Tx-	Transmit data negative
4	Rx	Receive data negative

7.3.5 Lütze Link Interface (LLK) / FBUS Link Interface (FBL) X8

Pin	Signal	Description
1	Vcc	+24V RS485
2	Data+	TxD+ / RxD+
3	Data-	TxD- / RxD-
4	GND	0V RS485
5	--	Not connected

7.3.6 USB interface X12

Pin	Signal	Description
1	VBUS	+5V
2	D-	Data -
3	D+	Data +
4	GND	0V

8 Initial operation

NOTICE

You will find detailed instructions about the programming of the safety control unit in the system Application manual, see “Other applicable documents” on page 8.

The system must be fault-free during commissioning, both with new installations and when exchanging spare parts. System validation must be carried out during commissioning.

DANGER

Risk to life and of personal injury through faults during commissioning.

Commissioning of the system includes validation. If this is not carried out correctly, this can result in serious operational faults that can impact on the operation of the whole system.

The system must be commissioned by qualified staff.
The staff must have received detailed and precise training on how to work with the control systems.
During commissioning, only the commissioning staff may be in the train.
Do not leave the system in Debug mode (force) with manually set variables unattended during commissioning, as important safety functions are not active in this operating mode.
Check all points on the check list before commissioning and document this.
Check for possible influences on the system's behavior.
Carry out a complete functional test.
Check the correct assignment of the connected safety components.

SIL relevant LION-9015

The safety control unit should only be commissioned once it has acclimatized.

8.1 Requirements of the commissioning staff

Commissioning work may only be carried out by correctly trained staff who, in particular, can understand and follow the safety regulations.

8.2 Checking the power supply

Before commissioning the safety control unit, you must ensure that power is supplied through a LION power supply unit and that it is correctly connected. Commissioning can only be done once this check has been carried out.

SIL relevant LION-9039

Please ensure during commissioning, that you only commission the safety control unit together with the LION PS power supply unit and other system components, as necessary.

8.3 Loading applications

You will find detailed instructions about this in the system Application manual.

8.4 Project download from the PC

You will find detailed instructions about this in the system Application manual.

8.5 Commissioning procedure

Commissioning is split over the following sections:

1. Switch-on and initialization.
2. Function testing.

8.6 Switch-on and initialization

The safety control unit offers 20 LEDs as display elements. The LEDs are used during initialization (start-up phase) of the control unit operating system. For details of how the LEDs behave during the start-up phase, please refer to Chapter 7.3 for the controller and 8.3 for the F-Bus module.

After switching on the power supply, all system components of the LION system must have reached a certain internal operating state before they can be addressed by the safety control unit.

If there is a boot project, this is now loaded and displayed in the LED status.

Even if the L-Bus² initialization was not successful, the boot project is loaded and the user program code is executed.

That means that you can use the safety control unit and the further units without the L-Bus² module.

8.7 Function testing

Two states can occur after switching on the LION SAFE CCU system:

- No boot project available. In this state, the controller waits for communication with the programming system.
- Boot project available. The boot project is loaded during switch-on.

Make sure that the correct application projects are loaded in the safe and non-safe part of the controller and continue with the validation of the system.

SIL relevant LION-9040

Safety testing of the application and the complete system is necessary, in line with the requirements of DIN EN 50129.

9 System validation

All the safety functions and the fault-free functioning of the installed and programmed system must be tested during commissioning. The system testing must be documented.

DANGER

Risk to life and of personal injury through faults during commissioning.

Commissioning of the system includes validation. If this is not carried out correctly, this can result in serious operational faults that can impact on the operation of the whole system.

- The system must be commissioned by qualified staff.
- The staff must have received detailed and precise training on how to work with the control systems.
- During commissioning, only the commissioning staff may be in the train.
- Do not leave the system in Debug mode (force) with manually set variables unattended during commissioning, as important safety functions are not active in this operating mode.
- Check all points on the check list before commissioning and document this.
- Check for possible influences on the system's behaviour.
- Carry out a complete functional test.
- Check the correct assignment of the connected safety components.

9.1 Function test

The function test is a significant part of the validation of the complete system. The fault-free assignment of the network safety components and the programmed logic of the system can be determined through the function test.

Use the project documentation that is printed out through SAFEPROG® for the execution of the function test. Advice about working with the project documentation can be found in the Programming manual.

Depending on the complexity of the connection logic, it can be advisable to carry out step-by-step function tests.

We recommend the following procedure for the execution of the function test:

1. Electrically separate all actuators from the output terminals.
2. Test the connection logic by forcing variables in the secure programming interface SAFEPROG®.
3. Check whether the behaviour of the logic corresponds to the expected function. Also check whether the evaluation for multi-channel safety components is done on a multi-channel basis.
4. Only connect the actuators with the safe output terminals if no faults are identified when testing the connection logic.
5. Carry out a complete functional test with all the sensors (initiators), switches and actuators.

To carry out the function test, trigger all the safety functions one after the other and document how the system reacts. Check whether the reaction corresponds to the expected behavior.

The function test must return the following results:

- The logical assignment of all system components is correct
- The assignment of all system components is complete

As opposed to the case with the I/O terminals, the logical assignment of outputs is done by checking the display of one LED. The bit xx is set in the secure programming environment for this purpose. The display at the expected output has to be checked after activating this bit. The corresponding displays at the non-addressed outputs should not be active during this test. If this is not the case however, there is a configuration fault in the system. In such a case, the system may not be commissioned.

6. Archiving the project data

After the function test has been successfully completed, it is recommended that all data from the control system are archived. Creating this copy is helpful if swapping out the device, in the case of a device fault in the controller.

10 Maintenance

The LION SAFE CCU device has no wear and tear parts and requires no preventative maintenance.

If you have any questions about the product or the repair service, please contact the manufacturer.

10.1 On-site module exchange

If a device has to be exchanged in the field, the maximum exchange time is 10 minutes.

Please proceed as follows with a possible exchange:

1. Identify the module that has to be exchanged. That can be done for example, by evaluating the diagnostics messages.
2. Switch the system's power supply off.
3. Separate all connected cables/plugs.
4. Dismount the device that is to be exchanged.
5. Mount the new device.
6. Connect the device with the peripherals.
7. Power up.
8. Test the system for any faults, taking the functional safety of the whole system into account. To this end, carry out a validation of the equipment, if necessary.

10.2 MTTR (Mean Time to Restore)

SIL relevant LION-9036

All LION devices have a MTTR of 7 days. This means that once a fault is identified on the device, the device has to be exchanged within 7 days.

10.3 Product life cycle

The product life cycle of the safety control device is based on the MTBF values calculated in accordance with EN/IEC 61709.

If you have any further questions, please contact our service department.

10.4 Proof Test Interval

SIL relevant LION-9037

The modules of Safety Class 2 are intended for a maximum service life.

For the service life of the assemblies, we assume an average service life of a rail vehicle in which there is no accumulation of dangerous failures that exceed the determined hazard rate.
The MTBF and hazard rates determined during the development phase are checked quarterly using a field data analysis and necessary measures are taken if the values deviate from the statistics.

10.5 Firmware update

The safety of the complete system can be impaired by a wrongly applied update. Updates may only be applied by the manufacturer. You may only carry out an update with the approval of the manufacturer.

11 Shutdown and disposal

You must observe the environmental guidelines applicable to the location of the respective country when it comes to the decommissioning and disposal of the modules. The device must be fully dismantled for disposal. Electronic components must be disposed of according to the national electronic scrap directive.

You assume the obligation to dispose of delivered goods after the end of use at your own expense in accordance with the legal regulations. This relieves the manufacturer of the obligations under §10 para. 2 ElektroG (take-back obligation of manufacturers) and related claims of third parties. If you pass on the goods to commercial third parties and they are not contractually obliged to take over the disposal and further obligation, it is incumbent upon the customer to take back the delivered goods at their expense after the end of use and to dispose of them properly according to the legal regulations.

The claim of the manufacturer on assumption of obligation / release from obligation by the customer does not lapse until two years after the final termination of the use of the device. The two-year period of expiry begins at the earliest, with the receipt of written communication from you to the manufacturer about the end of use.

12 Check list

12.1 System planning

ID	Request	Reviewed
	A risk assessment has been carried out and the required SIL levels have been determined.	☐
	The system certification exists.	☐
	The module printing advice is legible.	☐
	The MTBF and HR values have been checked.	☐
	Only LION power supply modules are being used.	☐
	The wiring complies with valid standards and guidelines.	☐
	The field power supply for the L-Bus² I/O modules is correctly sized.	☐

12.2 Installation

ID	Request	Reviewed
	The equipment has been correctly installed, in line with the instructions.	☐
	The required installation spacing to other components has been adhered to.	☐
	The modules are fixed to a DIN hat profile rail.	☐
	In accordance with the regulations, the modules are connected to the PE potential (grounded).	☐
	It has been ensured that there are no short-circuits resulting from the wiring of the inputs and outputs.	☐

LION-9011	A wiring check has been carried out in line with the installation plan.	☐
	All connectors are labeled in accordance with their assignment.	☐
	It has been ensured that the isolation of the wiring does not lead to any faulty contacts.	☐
	The reliability of all terminal connections was checked by applying mechanical tensile stress.	☐
	A visual check was carried out on all installed components.	☐
	The components fulfil the environmental conditions stipulated in the application. (The deployed cable meets the specification.)	☐

12.3 Environmental conditions

ID	Request	Reviewed
LION-9038	It was checked that the environmental conditions defined for the components will not be violated by the prevailing environmental conditions	☐
	The system fulfils the required protection class.	☐
	Pollution degree 2 is adhered to.	☐
	The maximum deployment height is adhered to.	☐
	The modules are supplied with the nominal voltage in accordance with the data sheet.	☐
	The ambient conditions defined in the data sheet for the operating temperature are adhered to.	☐
	The ambient conditions defined in the data sheet in respect of the maximum deployment height are adhered to.	☐
	The maximum number of permissible I/O modules on the L-Bus² is adhered to.	☐

	All required L-Bus² bus termination plugs and protective plugs are in place.	☐
	A successful system isolation test has been carried out.	☐

12.4 Configuration

ID	Request	Reviewed
	The I/O modules are wired in accordance with the described block diagram, in order to achieve the required SIL level.	☐
	The development process of the application software was carried out and documented in accordance with functional secure processes.	☐
	The safe states of the deployed components have been checked.	☐
	The safe fault reaction of the deployed components have been checked.	☐

12.5 Commissioning and validation

ID	Request	Reviewed
	It has been ensured that all safe communication devices from one system, e.g. devices on the LLK, have a unique, safe device address.	☐
	It has been ensured that the bus has been activated through a bus termination at the last LLK device.	☐
	The safety cycle time has been determined and set in the safety control unit.	☐
	The maximum reaction time was mathematically verified against the defined cycle time.	☐
	The system wiring was checked before operation.	☐
	The system starts up without any faults.	☐

	A complete function test has been carried out and documented.	☐
	Operations staff have been instructed on how to work with the control system.	☐

12.6 Maintenance

ID	Request	Reviewed
	Maintenance staff have been instructed on how to work with the control system.	☐
	Maintenance staff have been instructed with regard to the proof test interval.	☐
	Maintenance staff have been instructed with regard to the MTBF.	☐
	After working on the system, all requirements from the check lists for planning, installation and commissioning/ validation are also fulfilled.	☐
	The calculated reaction times following modification/refit are still fulfilled (evidence required).	☐
	A complete function test has been carried out and documented.	☐

13 Attachment

13.1 Accessories

Description	Type	Order number
L.Bus² bus termination plug	LION-LB-TERM-CON	800201
L-Bus² dummy connector	LION-LB-DUM-CON	800202
L-Bus² 1:1 connection cable	LION-LB-1:1-CON	800203
EMC Shield set	LION-SHIELD-CLIP-SET	800204
I/O Plug connector set 5-pin and coding elements	LION-IO-CON-SET-5	800208
I/O Plug connector set 6-pin and coding elements	LION-IO-CON-SET-6	800209
I/O Plug connector set 10-pin and coding elements	LION-IO-CON-SET-10	800210
I/O Plug connector set 12-pin and coding elements	LION-IO-CON-SET-12	800211

13.2 Assignment of safety-critical usage rules from safety audits to LION IDs

In this chapter, in order to simplify matters for the user, the assignment of safety-critical usage rules from the system audit to the LION-XXXX IDs in the product documentation is described.

Audit usage rules	LION ID in documentation	**Described in...**
Safety control unit 8.1.1	LION-9042	LION SAFE CCU Operating instructions
Safety control unit 8.1.2	LION-9036	LION SAFE CCU Operating instructions
Safety control unit 8.1.3		
Safety control unit 8.1.4	LION-9040	LION SAFE CCU Operating instructions
Safety control unit 8.1.5	LION-9002	LION SAFE CCU Application manual
Safety control unit 8.1.6	LION-9005	LION SAFE CCU Application manual
Safety control unit 8.1.7	LION-9006	LION SAFE CCU Application manual
Safety control unit 8.1.8	--	Function not released
Safety control unit 8.1.9	LION-9007	LION SAFE CCU Application manual
Safety control unit 8.1.10	LION-9026	LION SAFE CCU Application manual
Safety control unit 8.1.11	LION-9008	LION SAFE CCU Application manual

Safety control unit 8.1.12	LION-9012	LION SAFE CCU Application manual
Safety control unit 8.1.13	LION-9023	LION SAFE CCU Application manual
Safety control unit 8.1.14	LION-9011	LION SAFE CCU Operating instructions
Safety control unit 8.1.15	LION-9005	LION SAFE CCU Application manual
Safety control unit 8.1.16	LION-9009	LION SAFE CCU Application manual
Safety control unit 8.1.17	LION-9039	LION SAFE CCU Operating instructions
Safety control unit 8.2	LION-9004 LION-9028 LION-9029 LION-9031	LION SAFE CCU Application manual
Safety control unit 8.2.1	LION-9011	LION SAFE CCU Operating instructions
Safety control unit 8.2.2	LION-9038	LION SAFE CCU Operating instructions
Safety control unit 8.3.1	LION-9010	LION SAFE CCU Application manual
Safety control unit 8.3.2	LION-9040	LION SAFE CCU Operating instructions
Safety control unit 8.4	LION-9037	LION SAFE CCU Operating instructions
F-Bus Module 8.1.1	LION-9042	F-BUS module Operating instructions
F-Bus Module 8.1.2	LION-9036	F-BUS module Operating instructions
F-Bus Module 8.1.3	LION-9043	LION SAFE CCU Application manual
F-Bus Module 8.2	LION-9004 LION-9028 LION-9029 LION-9031	LION SAFE CCU Application manual
F-Bus Module 8.4	LION-9037	F-BUS module Operating instructions
F-Bus Module 9	LION-9041	F-BUS module Operating instructions
Safety control unit 3.10 F-Bus Module 3.10	LION-9044	LION SAFE CCU Operating instructions and F-BUS module Operating instructions

13.3 Amendment index

Version	Revision	Date
00	First version	13. 06. 2017
01	Updating data and ID in chapters 4, 6, 8, 10, 12 & 13	2017-07-27
02	Updating and improvements in chapters 2, 3, 4, 7, 8, 9 & 10	2017-11-10
03	Preparation of a neutral manufacturer's version of the operating instructions (i.e. neutral content /no company logos).	2018-04-27
04	New SIL-relvant note LION-9044 in chapter 3.10; chapter 6.5 minor text corrections; chapter 13.2 New: LION-9044	2019-06-13
05	Updating and new notices in chapter 6.5, 6.7; 7. New: Numbers in product overview graphic; 7.1.2 New Controller CPU: SITARA AM4379 (Cortex A) A9 1Ghz	2019-06-19 2024-12-03
06	Updating chapter 10.3 Product life cycle / Service life, 10.4 Proof Test Interval.	2025-03-06
07	Product overview added; chapter 4.4.1 “Safety control unit HR” updated	2025-03-25