

Lithium-Ion-Battery System: Platform Rail

Modular and scalable lithium-ion battery system for traction and auxiliary applications.

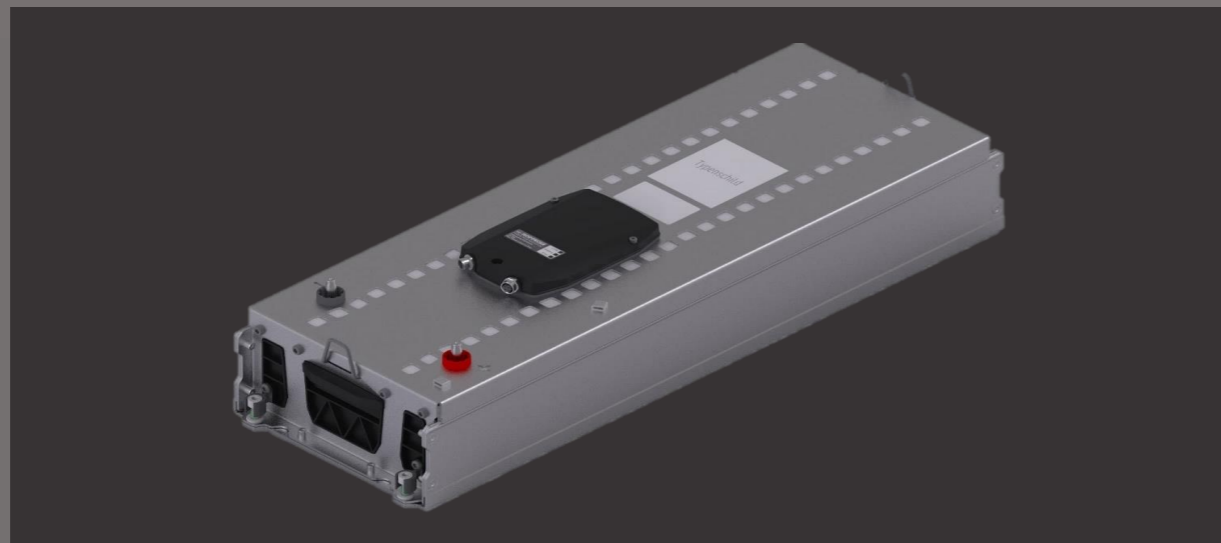
LiAux®

The auxiliary battery system LiAux® achieves some of today's overall objectives: Reducing weight, saving space, and increasing energy availability. Compared to conventional technologies LiAux requires fewer maintenance hours, thus reducing lifecycle cost. LiAux excels through long lifetime based on years as well as discharge/ charge cycles. Its open-technology architecture ensures flexibility and future proofing.

LiTrac®

The traction-battery system LiTrac® can be scaled to suit almost all traction applications. Voltage, energy content, current and lifetime characteristics can be adapted to the requirements of battery-only as well as hybrid traction systems. By using software-driven control units LiTrac can handle today's as well as tomorrow's cell technologies.

LiAux® and LiTrac® meet highest safety standards (e.g., SIL 2)



Advantages of LiAux® and LiTrac®:

1. High quality engineering:

- High safety standards (SIL 2 according to EN 50129 & EN 50657)
- External safety assessment to facilitate homologation process.
- Fulfillment of relevant railway standards
- High reliability

2. Modular system:

- Scalable to requirements
- High energy and power density
- Suitable for a wide range of applications
- NMC & LTO technology

3. Product advantages:

- High energy density
- Long lifetime
- Low-maintenance solution

4. Reliable partner:

- Worldwide service network
- Production in Europe, North America, and Asia

Technical Data

LiTrac® and LiAux® battery systems are composed of standard components qualified and tested in accordance with the latest railway standards, thus reducing costs and time needed for homologation processes.

Cell Modules:

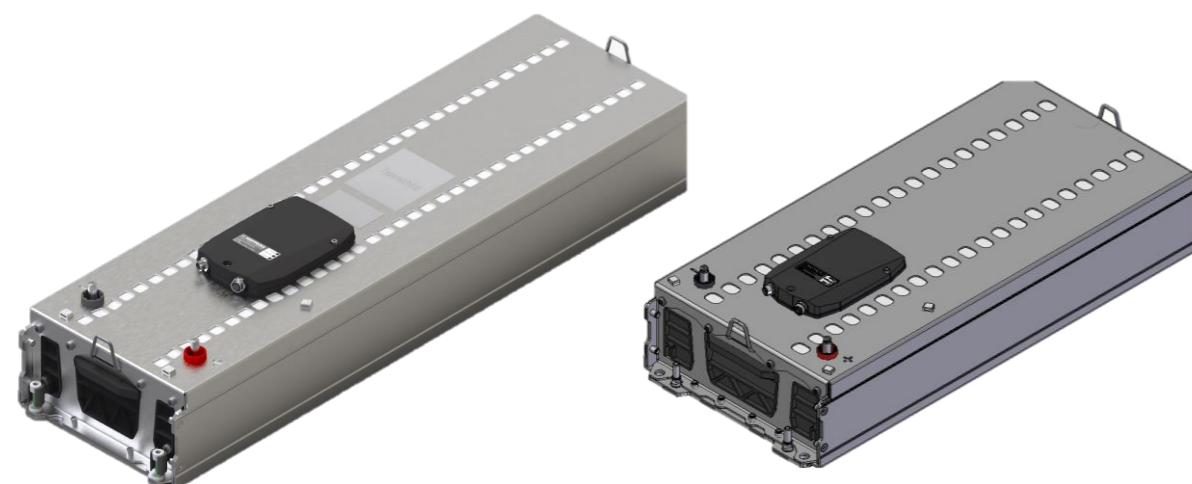
A comprehensive portfolio of cell-module configurations based on LTO and NMC cells, facilitates the fulfilment of crucial requirements in terms of voltage, energy and power. Furthermore, each cell module comes with an integrated electric heating element.

LiTrac Cell Modules

Designation		41HL69	41HL92	32HL115	32HL138	52HN174	52HN232
Cell Chemistry		LTO				NMC	
Nom. capacity	Ah	69	92	115	138	174	232
Nom. module voltage	V	41	32	52		52	

LiAux Cell Modules

Designation		27HL253	23HL253	23HL368	37HN116	37HN174	37HN232
Cell Chemistry		LTO			NMC		
Nom. capacity	Ah	253	253	368	116	174	232
Nom. module voltage	V	27	23		37		



Control Units

Breaker Box:

Positioned between the Cell Modules and the Switchbox, the Breaker Module connects and disconnects the battery from the vehicle. It also incorporates fuses to prevent damage in case of short-circuits.



Master Module:

The Master Module is the central communication hub of the battery exchanging operational data with a vehicle's on-board network. The Master Module is responsible for logging internal data, diagnosis and providing software updates to other components.



LiAux

LiTrac

Switch Box:

The Switch Box provides the power connection between string and vehicle. It contains the main contactors and a precharge circuit. Furthermore, it can measure voltage, current and the isolation resistance of a battery string.



Essential SIL2 safety functions are implemented in Switch Box and its software.

1. Modular & scalable

- ▶ Based on modular components and parametrizable software solutions, specific project requirements in terms of power, energy and voltage can be fulfilled
- ▶ High-power as well as high-energy solutions

3. Data recording & monitoring

- ▶ Cloud-based intelligent Diagnostics and Alert System **iDASys**
- ▶ Real-time system data transmitted to train-driver dashboard
- ▶ Early system-anomaly detection and notification to prevent service interruptions

2. Safety concept

- ▶ Critical cell states prevented by SIL 2-qualified hardware safety circuit
- ▶ Functional safety according to :
 - EN 50129 - Hardware
 - EN 50657 - Software

4. Thermal management

- ▶ Liquid cooling interface (LiTrac® only)
- ▶ Low maintenance effort
- ▶ Cell temperature management for a long service life
- ▶ Integrated cell-module heating

Hoppecke Rail Service

Based on the international **HOPPECKE SERVICE NETWORK** we support our customers in achieving their goals by offering a comprehensive portfolio of tailored services:

1. Avoid downtime:

- Availability of spare parts & storage solutions
- Cloud-based monitoring & pro-active interventions
- Condition-based maintenance
- Training of ECM-maintenance personnel to perform corrective interventions (certification courses)

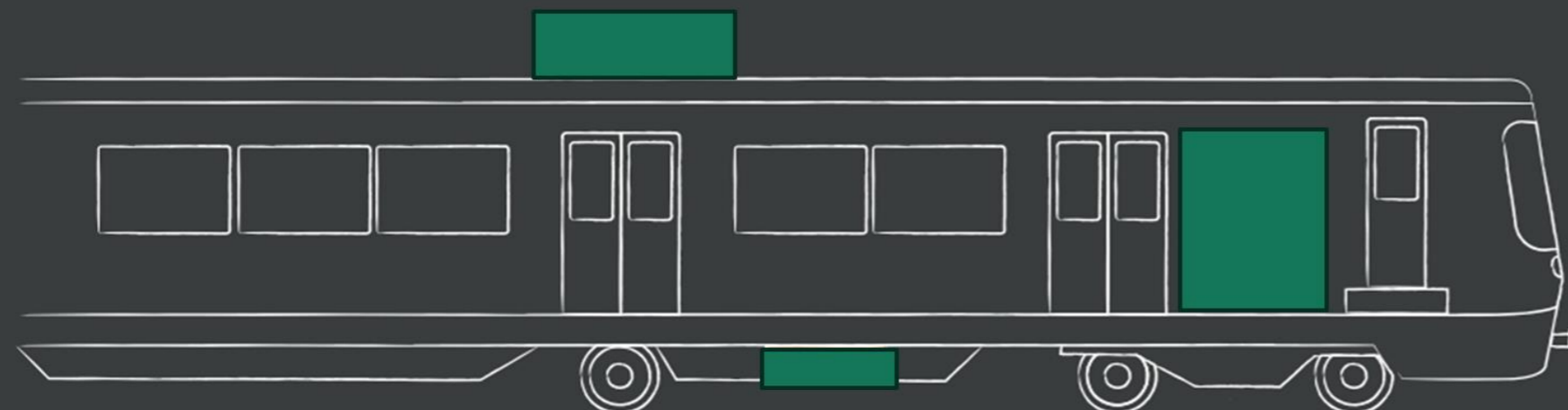
2. Increase productivity:

- Availability of technical support (online & local)
- Visualization of relevant operational data in target-audience-designed dashboards
- Continuous improvement through monthly smart reports and annual expert consultings

3. Financial transparency:

- Optional guarantees for
 - Lifetime (remaining system capacity)
 - Function (functioning of battery system)
- Projections (e.g. remaining battery lifetime)

Potential mounting options: Roof, underfloor and interior battery compartment



On track for the future

Today's requirements for rolling stock are challenging: More passengers, higher safety standards, lower emission rates & life cycle costs, less weight as well as increased fleet availability & travel quality.

HOPPECKE's **LiTrac**® and **LiAux**® Systems are part of the solution. Connect with us to explore how we can work together!

