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Reliable Power for Autonomous Vehicles

Power Requirements & Engineering Challenges Battery is the beating heart of every autonomous vehicle

By Christian Gaugler

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PE&ES event 2026

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Today's Agenda

01

Intralogistics 2026+

Why automation demands smarter power

02

Versatile Applications

Intralogistics · Marine AUV · Mobile Platforms

03

Charging – Wired or Wireless

Charging strategies · Benefits & use cases

04

Your experience today

Q&A · Live demos · Contact

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Intralogistics 2026+
Automation Is Non-Negotiable

Automated Guided Vehicles & Autonomous Mobile Robots

AMR follows fixed path, requires pre-installed infrastructure
AMR navigates independently via SLAM, LiDAR, depth cameras
Operate 24/7, in industrial environments, fully electrically powered
Payload 36 kg (light AMR) up to 1,500 kg (heavy-duty AGV); run-time 4–14 hours

24/7 Uptime Demand

Autonomous fleets cannot tolerate downtime. Power must be always-on and predictable.

Scalability Pressure

Warehouses scale from dozens to hundreds of robots, battery systems must scale with them.

Safety & Compliance

Enclosed environments demand certified, thermally stable, and mechanically robust energy storage.

Battery Technology

High energy density -> ideal for compact & lightweight AMRs (NMC)
High cycle life + thermal stability → essential for 24/7 heavy duty AGV´s (LFP)

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Battery is the beating heart of every autonomous vehicle

Power Requirements & Engineering Challenges

Weight vs. capacity
The battery accounts for a large proportion of the total vehicle weight in compact AMRs → direct impact on payload capacity, energy efficiency and vehicle dynamics

Thermal management
Highly variable load profiles due to frequent sprint/stop cycles → demand Requirements on thermal stability and active/passive thermal management

Integration
Compact design constraints: IP rating, power & data connector positioning and reliable bus communication

24/7 continuity
Maxtime uptime with minimal downtime and intelligent charging scheduling

Lifespan vs. TCO
total cost of ownership over 5–8 years

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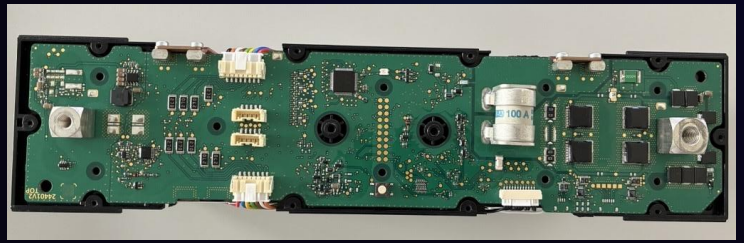
BMS Master Slave concept

Core functions of a BMS

SoC (State of Charge) estimation.

SoH (State of Health) monitoring.

Protection (overcurrent, overvoltage, temp).



Fixed Node IDs

Each battery gets its own fixed Identity within the CAN network.

Individual PDOs

Every module sends its own values for traceable pack-level Insight.

Master Summary

Node 27 provides the summarized view of the complete battery system.

Clear roles. Structured data. Full system visibility via CAN.

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NMC vs LFP DLFP 48V — The Leap Forward

IP65 Rated

LFP offers superior thermal stability
Less stringent cooling needed
DLFP offers IP65 rating

2.300 Wh / 45 Ah

NMC offers higher density but comes with higher production cost
DLFP 51.2 V · 45 Ah · 2.300 Wh. Highest energy in the EasyBlade range
DLFP is scalable up to 46 000 Wh

3.000+ Cycles

Dramatically longer cycle life → lower TCO for 24/7 ops.
2C charge rate for rapid turnaround
Overall lower production cost
Higher sustainability

20 Packs Parallel

Scale up to 20 packs in parallel , purpose-built for demanding autonomous platforms.

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Marine AUV & Submarine Platforms

IP65 for Harsh Environments

IP65 rating makes it the natural choice for marine and subsea deployments where moisture ingress is critical.

Cycle Longevity

Deep-discharge cycles typical in AUV missions, dramatically reducing total cost of ownership.

Mission Range

Maximum energy density per pack extends dive duration and operational range for autonomous underwater vehicles.

Scalable Parallel Architecture

Parallel configure mission-specific energy budgets without changing the platform design.

Battery Technology

NMC: High energy density for extended mission range

LFP:Superior cycle life + IP65 suitability for marine environments

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Mobile & Drivable Platforms

Service Robots

Lightweight, compact battery solutions are essential for service and Delivery robots operating in public and indoor spaces.
→ High energy density (NMC) enables longer runtime in weight and space-constrained designs

Autonomous Shuttles

48V systems power last-mile autonomous shuttle platforms with Extended range requirements.
→ Balanced energy content and runtime are key, both technologies can be used depending on payload and duty cycle.

Ground & Aerial Drones

Peak discharge capability is critical for handling motor start – surges and dynamic flight/drive maneuvers.
→ High power density and pulse capability (typically NMC) supports demanding transient loads. LFP can be suitable for heavier ground applications.

Outdoor Mobile Equipment / Green Garden Houses

All weather and harsh environment deployment requires robust protection.
→ High IP rating, thermal stability and cycle Life (typically LFP) are advantageous for outdoor, long-term operation.

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Checklist for Design-in

Mechanical

Form factor, IP-class, Shock/Vibration (IEC 60068), fixation

Thermal

Temp range, Cooling strategy, Thermal runaway prevention

Electrical

Voltage range, Peak/Continuous current, Comms (CAN), Isolation

Safety & certifications

IEC 62133, UN 38.3, UL 2580/IEC 62619, CE/UL

Operational

Charging profile, DoD management, SoC & SOH monitoring, automation, ...

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Intelligent Wired Charging

Algorithm-Matched Charging
Multiple charge algorithms, perfectly matched to Application Specific Batteries.

CAN Bus Integration
Native CAN communication enables BMS dialogue, real-time state-of-charge monitoring and adaptive charge control.

High Efficiency
Up to 94% efficiency, minimises energy waste and heat generation during every charge cycle.

Compact & Robust
IP66-rated enclosure. Designed for demanding industrial environments with minimal installation footprint.

94%
Charge Efficiency

IP66
Enclosure Rating

3x
Voltage Profiles
24V · 36V · 48V

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Wireless charging on industrial scale: Charge Without Contact

True Wireless Charging

Inductive power transfer. No connectors, no wear, no manual intervention. Robots charge autonomously at any stop.

Opportunity Charging

Charge during micro-stops, docking, or idle moments. Eliminates dedicated charge windows and maximises uptime.

Fleet-Ready Integration

Integrate with fleet management systems. Intelligent scheduling, monitoring and energy optimisation.

Safe & Certified

Foreign object detection, thermal management and international safety certifications built in as standard.

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Charging strategies

Strategy	Robot Downtime	Infra Cost	Battery Stress	Autonomy
Plug-in	High	Low	Low-Medium	Low
Swap	None	High	Medium	Medium
Opportunity (Wired)	Low	Medium	Low	High
Wireless / Inductive	Low	Medium-High	Low	Very High

Choice of charging strategy significantly influences battery lifetime, infrastructure investment and overall system availability. Opportunity and wireless charging benefit from batteries with high cycle stability.

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Benefits

1. Opportunity Charging in High-Throughput Areas

Frequent, short charging stops during natural process pauses (e.g. at conveyor belts or workstations)

Benefits: Minimal downtime, high vehicle autonomy, wired opportunity offers high power, wireless enables positioning tolerance

2. Clean Room / Food & Pharma Environments

No or minimal physical contact required

Benefits: Higher hygiene standards, reduced particle generation, easier cleaning and validation (especially wireless)

3. Heavy Traffic & Multi-Shift Operations

Continous operation with many vehicles in the same area

Benefits: no manual intervention, high scalability, both systems support predictable power availibility

4. Outdoor or Harsh Environments

Exposure to dust, moisture or temperature fluctuations

Benefits: IP-rated robustness and reduced maintenance (strong advantage for Wireless and robust wired systems)

Both Wireless and wired Opportunity Charging excel where high uptime, low maintenance and scalability are critical. The optimal choice depends on power requirements, infrastructure and environmental conditions.

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Use Cases Wireless & Wired

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Q&A – Live demo - Contact

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