



Marelli Pro and Elite Platforms

Insight Pack 4
Propulsion

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ABSTRACT

As automakers shift to software-driven and electric vehicles with advanced features, Marelli empowers engineering teams to bring pioneering, cost-contained innovations into series production by leveraging modular, high-tech concepts.

Building on pre-developed and validated technologies, Marelli's Pro and Elite platforms facilitate rapid roll-out across trims and model lines, providing a comprehensive portfolio of modular hardware and software features and solutions spanning Lighting, Electronics, Displays, Suspension and Propulsion.

Leveraging the purpose-built foundations of the Lean platform, the Pro platform introduces upscaled innovation for mainstream models, while the Elite platform delivers cutting-edge performance and design freedom for premium and luxury vehicles.

Our comprehensive portfolio papers detail the distinct advantages of each Marelli Pro and Elite platform—Pro and EliteLight, Pro and EliteZone, Pro and EliteCore, ProConnect, ProDisplay, Pro and EliteHorizon, EliteRide, and ProEnergy.

This fourth insight pack provides an in-depth focus on ProEnergy.



HARDWARE PLATFORMS INTRODUCTION

Aligning innovation with market demands is central to Marelli's strategy. Today, our modular hardware platforms underpin this strategic model, enabling automakers to rapidly address specific requirements across tiered market segments with high growth, high-market share products.

Leveraging deep cross-domain expertise to deliver integrated or standalone solutions at speed, Marelli's scalable platforms streamline development, optimize investment and support more sustainable vehicle architectures.

Developed to offer greater modularity, each platform targets up to 70% reuse of subsystems and components, significantly compressing R&D timelines and mitigating the risks of clean-sheet designs, while accelerating time to market.

Marelli rapidly advances concepts to the minimum viable product stage and co-engineers with OEMs to introduce future-proof features and functionalities.

As a result, automakers gain a technological edge and the agility to act as first movers, seizing early market share.

In addition to hardware, Marelli has developed software platforms that include standalone, decoupled software applications, as well as software-enabled tools and features that drive Software-Defined Vehicles (SDVs).

This integrated approach further fosters co-creation opportunities with automakers and expands personalization options for buyers.

Tailored to fulfill the diverse needs of different vehicle segments and buyers, Marelli's hardware platforms deliver significant competitive advantages, with scalability, cost efficiency, flexibility and reduced timeframes that help automakers get to market fast.

**Platform-powered
innovation: Accelerating
your time to market**

A TIERED SYSTEM: LEAN, PRO AND ELITE

Marelli's hardware platforms are structured around three scalable tiers – Lean, Pro and Elite. Each is designed to offer broad coverage across market segments while providing in-depth capabilities across various vehicle systems. With an emphasis on scalability, this model offers flexible, pre-engineered components that allow automakers to efficiently leverage technology without starting from scratch.

Lean is engineered for base trims, entry-level vehicles and value-driven brands. Its fit-for-purpose technology focuses on affordability, sustainability and speed. Lean emphasizes component simplification, reduced development time and design for manufacturing.

Pro puts the focus firmly on scalability. It is Marelli's most versatile and adaptable platform. It targets electric vehicles and mainstream vehicles that offer unique features beyond their class. This approach includes up-scaling well-established innovations from our Lean platform, or value-optimizing high-end features developed for premium vehicles. With the broadest range of customization and feature options, Pro is engineered to meet diverse consumer preferences and budgets across a wide array of vehicle segments.

Elite represents the pinnacle of Marelli innovation. A cycle of continuous investment and development keeps Marelli at the forefront of technological advancement, delivering industry-first products that set new benchmarks. As a result, Elite combines sophisticated features and high-content technology to meet the demands of tech-savvy end users and the most premium vehicle brands in the market.



Pro and Elite platform

Marelli's Pro and Elite platforms introduce advanced levels of feature sophistication and performance. Co-created with OEMs for mainstream models, EVs, and luxury lines, they balance next-generation functionality with targeted efficiency across components, wiring, energy management, manufacturing, and assembly.

Our Pro platform targets the point where feature sophistication, software content, and system integration begin to exceed entry-level architectures, frequently delivering innovative alternatives to state-of-the-art technology, offering much of their performance at a greatly reduced cost.

Our Elite platform pivotally balances groundbreaking innovation with a made-for-manufacturing mindset. Whether through Marelli-owned tooling, plug-and-play compatibility with existing vehicle architectures, or simplified assembly and validation processes, Elite platform solutions are engineered from the outset for series-production viability.

Each platform is founded on homologation-ready technology and remains highly adaptable to individual vehicle programs. Crucially, Pro and Elite platform technologies can be scaled and combined according to program needs, giving automakers the freedom to deploy advanced solutions at the pace and level best suited to each vehicle line.

Key outcomes include:

- More sophisticated features with a simplified architecture
- Faster time to market from pre-developed, production-mature foundations
- Flexibility to adapt to program-specific design, packaging and performance requirements
- Reduced manufacturing and assembly effort through consolidation of components, ECUs, modules and wiring
- Scalable, software-defined capability with Over-the-Air (OTA) upgrades
- Improved efficiency and sustainability through intelligent system design
- Architectural capacity to evolve functionality without major re-design
- Production-ready innovation – including plug-and-play compatibility, Marelli-owned tooling and homologation validation

THE PRO AND ELITE PLATFORM PORTFOLIO (Insight pack 4)

ProEnergy





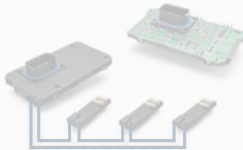

As battery technology advances, Marelli’s new-generation Battery Management Control Unit (BMCU) addresses the increasing hardware and software complexity in energy management – building on expertise from the innovative first implementation in the 2010 Nissan Leaf.

The BMCU monitors the condition of battery cells to ensure safety, maximize driving range and prolong battery life. Marelli’s solutions for Battery Management Systems (BMSs) offer benefits such as reduced system complexity and cost with improved efficiency.

This new generation of BMCU is built on Marelli’s scalable Energy platform – an approach designed to streamline development and accelerate time-to-market. The platform strategy is a core part of Marelli’s innovation model, enabling automakers to quickly adapt to diverse performance and market requirements.

As illustrated below, our Energy platforms comprise three main product families – LeanEnergy, ProEnergy and EliteEnergy – with architectural variants tailored to specific needs. These solutions are co-developed in close collaboration with our Original Equipment Manufacturer (OEM) partners to meet market demands.

Marelli Energy Platform Portfolio

	LeanEnergy	ProEnergy	EliteEnergy*
Architecture	 <p style="text-align: center;">Centralized</p>  <p style="text-align: center;">Distributed wired</p>	 <p style="text-align: center;">Distributed wired</p>  <p style="text-align: center;">Distributed wireless</p>	 <p style="text-align: center;">Distributed wired</p>  <p style="text-align: center;">Distributed wireless</p>
System Voltage	400 V	Up to 1000 V	
SOC/SOH	Cell equivalent model		EIS + AI algorithm with high performance microcontroller
Platform	Microcontroller family, vehicle communication, battery monitoring ICs, I/O		
Custom	Mechanics (connectors, case) and PCB shape, customer-specific contents		

*Future development

Marelli's approach leverages modular design principles, where foundational components such as the main Microcontroller Unit (MCU), communication lines and battery-monitoring integrated circuits are shared across platforms, ensuring consistency and efficiency. Meanwhile, mechanical components are crafted to remain bespoke, enabling customization that aligns with OEM-specific integration requirements.

By targeting up to 70% reusability in our design efforts, Marelli aims to achieve an overall 20-25% reduction in time to market and a 20% reduction in bill of materials costs compared to project-specific products, all while capitalizing on economies of scale.

This streamlined approach paves the way for the timely market readiness of energy management solutions.

Distributed Wired and Wireless Battery Management Control Unit

ProEnergy is a state-of-the-art and highly adaptable BMCU for modern EV architectures spanning 400 V to 1000 V. Building on LeanEnergy's cost-effective foundations, it offers a more advanced feature set and Input/Output (I/O) designed for higher-voltage vehicles.

A choice of distributed wired or distributed wireless architectures is optimized for space-constrained vehicle layouts and for efficient scaling across different battery pack sizes and voltages.

The Battery Management Unit (BMU) can be located away from the battery pack when packaging constraints dictate, with cell monitoring and balancing delegated to modular Cell Supervising Circuits (CSCs) mounted directly on battery-pack modules. This results in very short wiring between the CSCs and cells, with a longer wiring harness linking the CSCs to the BMU through a daisy-chain loop. Regardless of battery voltage, the BMU remains identical, with the required number of CSCs added or removed to meet pack specifications. Optional wireless communication offers additional efficiencies through a significant reduction in communication cables, simplified battery-pack design and shorter assembly-line times. Despite a modest cost increase for the BMCU, it enables a net savings at vehicle level.

Standard battery management functions include State-of-Charge (SOC) and State-of-Health (SOH) calculations, thermal management, charge/discharge control, cell temperature and voltage monitoring, cell balancing and comprehensive safety management. A seamless interface with the E/E architecture enables functions beyond core battery control, such as safety triggers in the event of an impact.

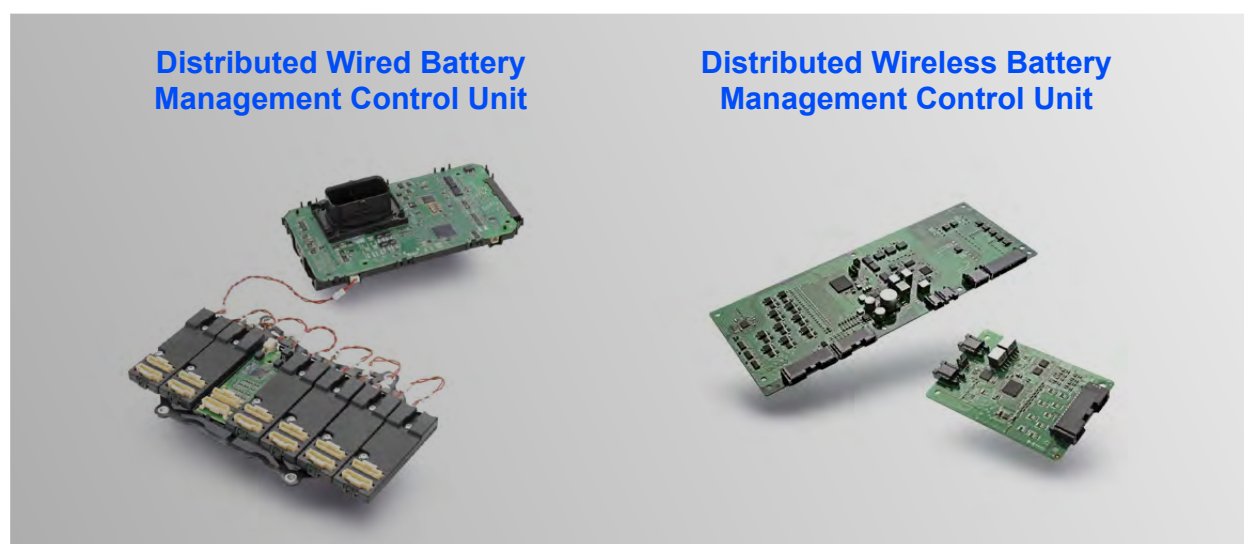
Advanced functions include a Real-Time Clock (RTC) with more accurate scheduling of balancing cycles when the vehicle is inactive, supporting improved battery life. A shunt sensor integrated on the edge of the PCB and mounted on the busbar improves current measurement and simplifies pack design, while solid-state pre-charge improves reliability at higher voltages.

To mitigate reduced charging speeds at lower voltage stations, ProEnergy includes dual-stack pack management with a switchable configuration. In architectures where an 800 V battery comprises two strings of 400 V, for instance, ProEnergy allows both strings to be charged simultaneously in parallel on a 400 V infrastructure.

A two- or three-board layout supports the separation of the low-voltage control board and high-voltage sensing board into independent PCBs, with flexible positioning of the high-voltage board for improved packaging and thermal performance. A third board can be specified when additional separation is required.

For functional safety, ProEnergy integrates a pyro-fuse in series with the main contactors to provide rapid, irreversible battery isolation in the event of a heavy impact or when a contactor fails to open.

To additionally reduce BMCU complexity, cost and dimensions, Marelli's future BMCU roadmap includes the introduction of a microcontroller-free architecture, in which the BMCU will transmit real-time cell data for processing in a Zone Control Unit. Looking further ahead, EliteEnergy will introduce Marelli's most advanced BMCU to date, with state-of-the-art functionality including Electrochemical Impedance Spectroscopy (EIS), AI-based algorithms to optimize battery management, and a high-performance MCU. With functions already in development, Start of Production (SOP) for EliteEnergy is targeted for 2030, with a foundation prototype available as early as 2028 – offering OEMs the potential to streamline development time and costs.



Need to know

- Distributed wired or wireless architectures
- Modularity supports 400 – 1000 V battery packs
- Dual-stack pack management
- RTC



Innovation @Speed.

At Marelli, we believe speed is the new currency in automotive. In a world defined by shifting consumer expectations, rapid tech evolution, and intense competition, getting to market faster isn't just an advantage — it's essential.

Marelli empowers automakers to move with speed and purpose. As a trusted technology partner, we offer scalable platforms, software-defined vehicle enablement tools, production-ready solutions, and fast innovation cycles designed to shorten development timelines and unlock early market opportunities.

We enable speed-to-market in four distinct ways:

- **Platform Products** – Tiered, modular hardware and software solutions engineered for speed, scalability, and smart customization.
- **Software-Defined Vehicle Enablement Tools** – Supporting future-focused E/E architectures with flexible hardware, decoupled software, and cloud virtualization tools that accelerate development.
- **Ready-to-Offer Technologies** – Proven, production-ready innovations built for immediate integration and impact.
- **Minimum Viable Product Innovation** – From concept to working prototype in as little as 90 days, our agile innovation process enables co-creation with automakers for rapid product development.

This paper illustrates how Marelli's Pro and Elite platform products accelerate time to market through modular, cost-effective design, pre-validated components, and streamlined integration.