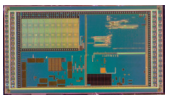
PELLENC energy

PREDYCE®

INTELLIGENT CELL MANAGEMENT IC

PREDYCE® is an all-in-one intelligent cell-level management device designed to individually monitor, control and balance lithium-ion battery cells.

PREDYCE®
64-pin QFN package



PREDYCE®
160 µm-thin
bare die

It measures **cell voltage and temperature, performs adaptive cell balancing** and communicates directly with the BMS. PREDYCE® exchanges **data through the existing power connections** — eliminating the need for additional sensing or communication harnesses.

The device integrates on-chip flash memory with two key functions: a **black box that logs relevant cell-level voltage, temperature and balancing data for post-incident analysis and degradation tracking;** and a **battery and cell passport** storing each cell's unique identity, usage history and state-of-health data for full lifecycle traceability and second-life assessment.

KEY ADVANTAGES

- **SINGLE-CELL MONITORING AND CONTROL**
  Cell-level voltage and temperature sensing with OV/UV redundant protection
- **INTEGRATED CHIP-ON-CELL ARCHITECTURE**
  Combines sensing, balancing, memory and communication in one compact embedded solution
- **POWERLINE COMMUNICATION THROUGH CELL CONNECTIONS**
  Energy-efficient communication using existing power connections, reducing harness complexity
- **SMART INDIVIDUAL BALANCING**
  Adaptive balancing from 10 to 300 mA peak, supporting ageing compensation and early abnormal behaviour detection.
- **TRACEABILITY, BATTERY PASSPORT AND BLACKBOX LOGGING**
  64 kB on-chip flash memory for event storage, battery/cell passport data and second-life traceability.
- **LOW-POWER OPERATION**
  Deep sleep mode below 1 µA with automatic wake-up capability.
- **ADVANCED BATTERY INTELLIGENCE**
  Supports accurate State-of-Charge, State-of-Health and Remaining Useful Life estimation at cell level.

PREDYCE® — Intelligent Cell Management in Action

KEY ELECTRICAL PARAMETERS

PARAMETER	TYPICAL VALUE	COMMENTS
Operating Range	-40°C up to 80°C	
Voltage Measurement Precision	2.3 mV per cell	From 1.5V up to 4.7V
Temperature Measurement Precision	2°C per cell	From -20°C up to 80°C
Flash Application Memory	64 kbytes	Dedicated to firmware
RAM Memory	16 kbytes	
Flash Black Box Storage	64 kbytes	
Consumption in Active Mode	< 1 mA	
Consumption in Low-Power Mode	< 1 µA	
ADC Precision	12 bits	
Conversion Time	300 µs	For voltage & temperature
Max Balancing Current	30 x 10 mA	Up to 300 mA per cell
Microprocessor Clock Frequency	4 MHz	
(Real Time Clock) RTC	32 kHz	
UART (Bridge mode)	115200b / 230400b	
RX High-pass filter	Order 6	
RX Low-pass filter	Order 4	

APPLICATIONS

ELECTRIC MOBILITY

Direct integration in high-voltage systems, with no extra harness, enabling safer and simpler battery packs.

UNMANNED AERIAL SYSTEMS (DRONES)

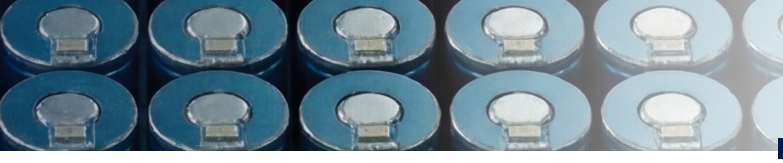
Cell-level data enables early fault detection, predictive maintenance and reduced downtime during operation.

ENERGY STORAGE SYSTEMS (ESS)

Embedded black box and cell passport ensure traceability, enabling second-life applications and improved recycling.

POWER TOOLS

Individual temperature sensing enables adaptive balancing, improving reliability and optimising performance.



PREDYCE® DEVICE - CORE FUNCTIONS

VOLTAGE SENSING

Measures cell voltage with high precision across the full operating range.

TEMPERATURE SENSING

Measures cell temperature to protect against thermal risks and optimise performance.

CELL BALANCING

Performs adaptive balancing up to 300 mA per cell to maintain uniform SOC and optimise energy efficiency.

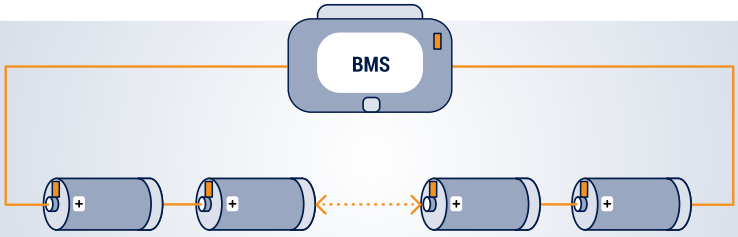
EMBEDDED MEMORY

Stores events, identity, usage history and SoH data for lifecycle traceability.

SYSTEM ARCHITECTURE - COMMUNICATION THROUGH POWER BUS

CONTROLLER-DEVICE PRINCIPLE

The BMS acts as the central controller, while each PREDYCE® operates as an intelligent device.
The bridge device within the BMS manages discovery, synchronisation and data exchange with all devices in the network.



CELL-LEVEL INTELLIGENCE

Each PREDYCE® device operates autonomously at the cell level, continuously measuring and managing its cell.
Data is time-stamped and stored locally for lifecycle assessment and post-incident analysis.

POWER-BUS COMMUNICATION

Communication between the BMS and each PREDYCE® device uses existing power connections, requiring no additional harness, reducing complexity, weight and cost while improving robustness in high-vibration environments.

DESIGNED FOR SCALABILITY, THIS DISTRIBUTED ARCHITECTURE SEAMLESSLY EXTENDS FROM 12 V SYSTEMS TO HIGH-VOLTAGE ARCHITECTURES ABOVE 1000 V, WITH FULL CELL-LEVEL VISIBILITY AND CONTROL.

PREDYCE® — Integration Flexibility at Every Level

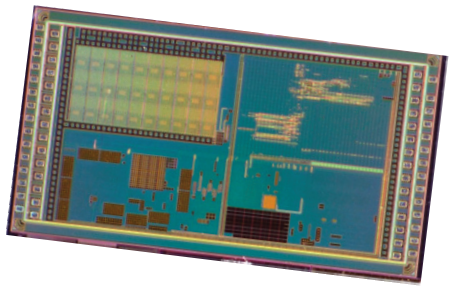
FLEXIBLE INTEGRATION FORMAT

PREDYCE® is designed to integrate seamlessly at every level of the battery system.
It is available as both a 64-pin QFN package for PCB-level integration and a 160 µm-thin bare die for direct cell connection. PREDYCE® delivers flexibility, performance and scalability for a wide range of battery architectures and manufacturing approaches.

64-PIN QFN PACKAGE

- Easy PCB integration with standard SMT processes
- Bridge mode capability for the main BMS

160 µm-THIN BARE DIE



- Direct integration on cell terminals
- Ultra-low profile for minimal footprint and maximum cell compatibility

In a complete system, the main BMS must integrate a PREDYCE® device in QFN package operating in Bridge mode to manage communication with all distributed cell-level PREDYCE® devices.

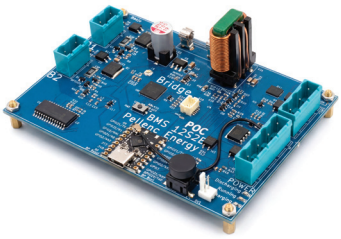
COMPATIBLE WITH MULTIPLE INTEGRATION ENVIRONMENTS

CYLINDRICAL CELLS

Direct connection to the cell's positive and negative terminals for true cell-level intelligence.

PRISMATIC CELL

Embedded or terminal-mounted integration - no harness required, maintaining pack-level flexibility.

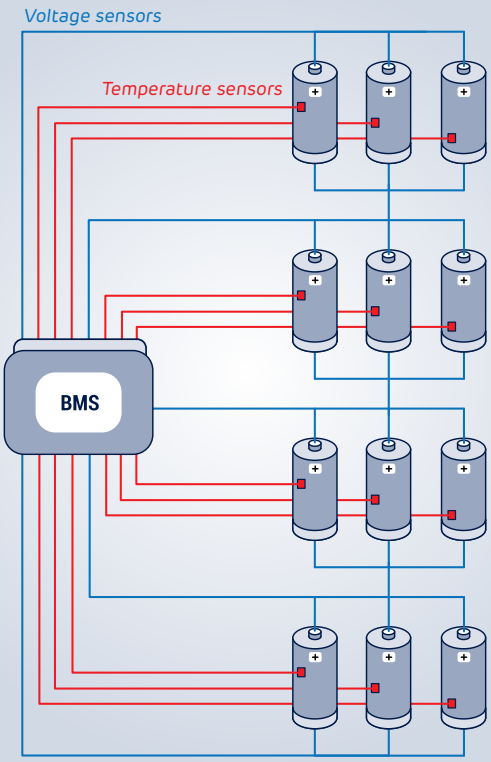


PCB INTEGRATION (QFN)

64-pin QFN package for cell, module or pack-level integration using standard PCB assembly processes.

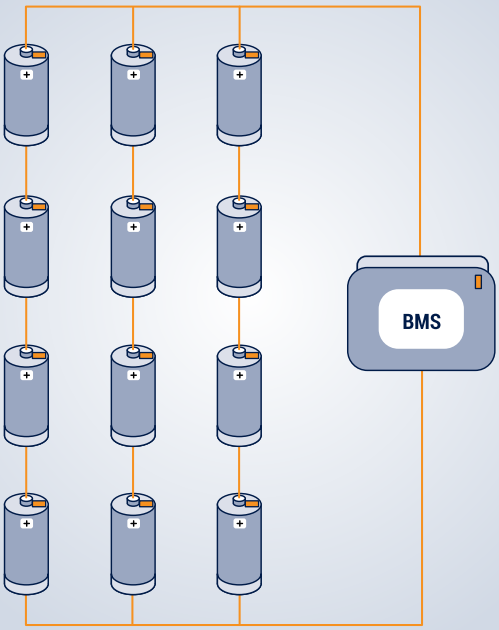
BATTERY ARCHITECTURE INTEGRATION

CONVENTIONAL ARCHITECTURE



VS

PREDYCE® ARCHITECTURE



MULTIPLE SENSE WIRES

Each voltage tap and temperature sensor requires dedicated wiring to the BMS, resulting in a large and complex harness.

VS

NO EXTRA HARNESS

Communication uses the existing power connections. PREDYCE® devices communicate and are managed through the same connections.

LIMITED VISIBILITY

Only group voltage is monitored; imbalances, weak cells and internal faults may go undetected.

CELL VISIBILITY

Each cell remains individually visible. Voltage, temperature and balancing are monitored for every cell.

HIGH FAULT CURRENT

In a cell short-circuit, adjacent parallel cells will discharge into the faulty cell and sharply increase the current through it.

LIMITED FAULT CURRENT

In a cell short-circuit, the higher resistance of the full series path keeps additional current significantly lower.

PREDYCE® — Unlocking Full Battery System Value

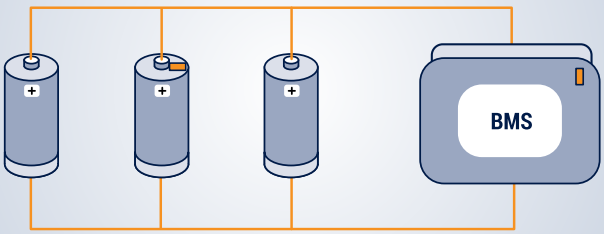
FROM COMPATIBILITY TO FULL POTENTIAL

PREDYCE® can be integrated into conventional battery packs with minimal disruption.
Its full value is realised when the design maintains true cell-level visibility, with cells connected in series within parallel strings.

COMPATIBILITY WITH CONVENTIONAL ARCHITECTURE

OPTION 1: ONE DEVICE PER PARALLEL GROUP

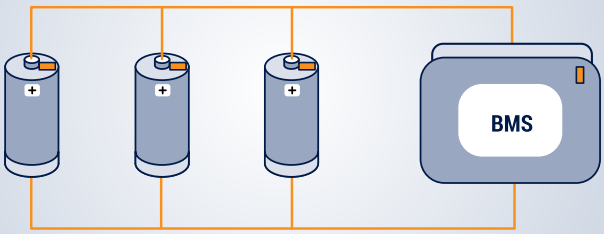
Close to a conventional BMS approach, with reduced harness complexity.



- Simpler wiring
- Lower harness count
- Cost-effective integration

OPTION 2: ONE DEVICE PER CELL IN PARALLEL GROUP

Provides more local temperature sensing, but parallel cells still share the same voltage.



- More local temperature sensing
- Same voltage shared among parallel cells
- Improved thermal resolution

UNLOCK THE FULL VALUE OF STRING ARCHITECTURE

TRUE CELL VOLTAGE MEASUREMENT

Each cell voltage is measured individually for accurate and reliable monitoring.

PER-CELL TEMPERATURE MONITORING

Thermal behaviour is monitored at each cell for improved safety and control.

PER-CELL BALANCING

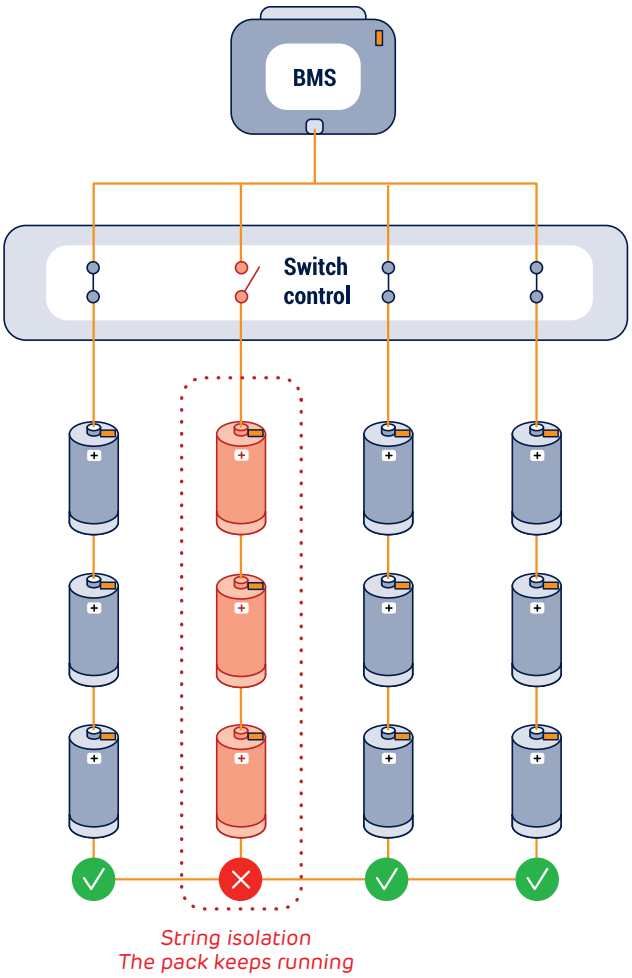
Balancing is applied individually at cell level for more precise and effective control.

LOCAL CELL DATA AND TRACEABILITY

Each cell carries its own identity, history and usage data for full traceability.

STRING-LEVEL SAFETY AND SYSTEM BENEFITS

PREDYCE® enables string-level control and visibility, allowing the BMS to isolate only the affected section of the pack when a fault is detected - while the rest of the system continues operating.



ACTIVE SAFETY AT THE SOURCE

Each cell is continuously monitored for voltage, temperature and events. Faults are detected early at cell level rather than at pack level.

FAULT CONTAINMENT

In case of a cell fault or thermal event, the BMS isolates only the affected string. The rest of the pack remains operational.

SAFE-BY-DEFAULT OPERATION

The battery spends most of its time with branch switches open, keeping the system in its safest operating state by default.

MAXIMISED AVAILABILITY

The pack continues to deliver power even with one or more strings isolated, which is critical for EVs, ESS, and mission-critical systems.

LIFECYCLE VALUE THROUGH DATA CONTINUITY

OPERATION

Real-time monitoring and balancing optimise performance and safety.

DIAGNOSTICS

Embedded memory logs events and trends for early insight and root-cause analysis.

SERVICE

Black-box data accelerates after-sales diagnostics, warranty decisions and repair actions.

SECOND LIFE

Cell passport data supports safe reuse and re-rating in new applications.

RECYCLING

Full usage history and composition data streamline sorting, vetting and recycling processes.

PELLENC energy

“Research and intelligence. Inside every cell.”

At Pellenc Energy, we develop next-generation battery technologies by combining electrochemical innovation, embedded intelligence and industrial expertise.

COME AND MEET US

We would be delighted to welcome you on site and present the PREDYCE® innovation in person.

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PREDYCE® BY PELLENC energy

LET'S BUILD THE FUTURE OF BATTERIES. TOGETHER.

Scan to visit our website and learn more about PREDYCE® technology.