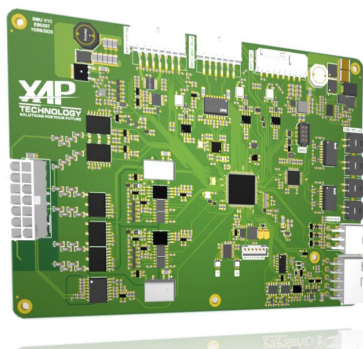


BMU-110



SMART CONTROL TOTAL PERFORMANCE

XAP Technology has forged its expertise at the highest level of motorsport, bringing this know-how to the new era of electric mobility.

The BMU is more than a standard controller: it is the decision-making brain of the battery, combining robustness, modularity, and advanced safety for retrofit, motorsport, and stationary storage applications.

Its master/slave architecture ensures unmatched scalability: a single BMU can manage an unlimited number of CMUs, enabling centralized and secure control of packs up to 900 V.

With 16-bit precision measurements, current sensing up to 500 A, advanced communication (CAN-FD, Ethernet, USB, Control Pilot) and built-in safety features (power relays, precharge, interlocks, HV insulation test), the BMU provides engineers with a powerful and versatile supervision platform.

Beyond monitoring State of Charge, Health, and Power, it integrates proprietary fault detection and balancing algorithms to guarantee reliability even under extreme conditions.



CENTRAL BRAIN OF THE BATTERY PACK

HIGH-VOLTAGE MEASUREMENT (HV):

Covers from light 48 V systems up to 800–900 V without hardware change.

HV INSULATION & SAFETY:

Accurate diagnostics, avoids ambiguous measurements with both relays closed.

RELAYS & PRECHARGE:

Control of 2 × 500 A contactors + precharge stage. Expandable via XAP Relay Board

CELL BALANCING:

Passive (standard/reinforced) and active/hybrid strategies.

POWER PREDICTION (SOP):

Electro-thermal algorithms computing charge/discharge current and power limits in real time. CAN output to inverter.

PACK THERMAL MANAGEMENT:

Closed-loop control (pumps, valves, fans, heaters).

INTEGRATED ACCELEROMETER/GYRO:

ICM-40627 (6-axis, fitted) for shock and abnormal movement detection.

COMMUNICATION:

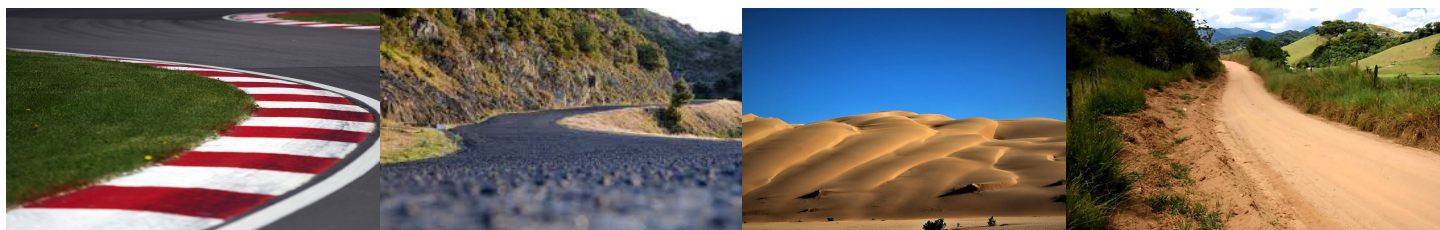
CAN-FD ×3 (separate vehicle/battery domains), USB (service/update), Ethernet (diagnostics), dedicated CMU buses.

INTERNAL LOGGING:

Records HV events (relays, precharge, isolation, HVIL)

CYBERSECURITY:

Protected wired update. Separated buses, CAN whitelists. | External telemetry (NT-Logger, 4G) read-only access.



► ELECTRICAL SOLUTIONS & POWERTRAIN:: **BMU-110**

ELECTRICAL SPECIFICATIONS

Voltage range	Multi-scale: 60 V / 230 V / 500 V / 900 V (auto-range switching)
Current measurement	Up to ± 500 A DC – dual path (Hall + shunt or dual shunt) with dynamic coherence check
Voltage resolution	12-bit ADC
Isolation test	Differential ISO_POS / ISO_NEG method (per TIDA-01513) – localizes fault leak (Riso > 500 Ω /V warn, 100 Ω /V fault)
Power protections	HV interlock, HVIL, reverse polarity, ESD, contact weld detection
Logic supply	7 – 75 V DC isolated DC/DC conversion, reverse polarity protected
Consumption	≈ 130 mA @ 12 V (active standby)

CONTROL & ALGORITHMS

State estimation	Real-time SoC / SoE / SoP / SoH computation (electro-thermal model, aging laws)
SOP prediction	Online power forecast — publishes charge/discharge limits via CAN DBC
Balancing	Passive / active hybrid balancing (ΔV , SoC, T° , I criteria with thermal limitation) Up to 4 logical packs, 1 – 64 CMU each (≤ 1088 cells) – Dual-Path architecture redundant
Pack management	Up to 4 logical packs, 1 – 64 CMU each (≤ 1088 cells) – Dual-Path architecture redundant
Thermal control	Closed-loop management of pumps, valves, fans, heaters
Pre-charge sequence	Automated current-limited charging with thermal feedback
Crash & HVIL	Continuous HVIL monitoring + pyro-fuse control with coherence check

MECHANICS & CONNECTIONS

Dimensions	$\approx 175 \times 125$ mm PCB (stand-alone board assembly)
Weight	< 500 g (board only, without housing)
Connectors	Industrial AMPSEAL / MicroFit / MC4 for HV monitoring and control
Mounting	4-point stand-off pattern / option metal shielded housing
Cooling	Passive (PCB conduction + HV resistance monitoring thermistor)

INTERFACES, I/O & CONNECTIVITY

BUS system	2 $\times$ CAN-FD isolated – 1 bus Vehicle / 1 bus Battery domain
Service links	USB (maintenance & firmware update, secured) / Ethernet (Diagnostics)
CMU interfaces	TPL
Safety inputs	Emergency Stop, HV Lock, cover sensors
Sensors supported	Accel/Gyro (ICM-40627), T° pack, T° busbars, H2 (Batt-Safe), isolement
Data formats	CAN frames standardized (DBC XAP), diagnostics and firmware updates via USB

DIAGNOSTICS, SECURITY, LOGGING

Event logging	Persistent journal (events HVIL, contactors, iso tests, pre-charge) with CRC & timestamp
Integrity chain	Secure boot + signed firmware + hardware-software pairing + rollback protection
Network security	Physical bus separation, whitelisted CAN IDs, timeout strategy, denial-safe fallback
Telemetry (Ext.)	NT-Logger / 4G modules read-only on CAN (FIFO buffer > 24 h network loss proof)
Crash proff	Coherence tests after impact, bus discharge sequence, trace retention for analysis

ENVIRONMENT & COMPLIANCE

Operating T° range	-40°C to $+85^\circ\text{C}$
Ingress Protection	IP65 with housing
Vibration/shock	Motorsport / Industrial qualified profile
EMC/CEM	Integrated filters & shielded layers per UNECE R10 / ISO 11452 (test reports on request)
Safety standards	ISO 26262 ASIL-B $\rightarrow$ ASIL-D (depending on function) / UNECE R100 / R136 / UL compliance
Reliability	Continuous operation > 13 000 h — active supervision by Batt-Safe sensor module

REFERENCE

PS0543	BMU-110
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