

Overcurrent Protection - Official Commercial BESS Technical Overview & Datasheet

OVERVIEW: OVERCURRENT PROTECTION FOR ENERGY STORAGE SYSTEMS

This document provides a comprehensive technical overview of the Overcurrent Protection (OCP) architecture integrated within our commercial Battery Energy Storage Systems (BESS). Designed for Tier-1 C&I, utility-scale, and micro-grid deployments, this protection suite ensures hardware longevity, operational safety, and grid code compliance under all fault conditions.



SYSTEM ARCHITECTURE & SAFETY LOGIC

The Overcurrent Protection framework operates across four hierarchical layers: Cell-level internal current interrupt devices (CID), Module-level DC fast-acting

fuses, Rack-level high-speed molded case circuit breakers (MCCB), and System-level PCS AC/DC coordination with solid-state limiters. Redundant trip logic based on real-time busbar current sensing (1 kHz sampling) and thermal modeling ensures disconnection within <2 ms for short-circuit events.

KEY FEATURES

- Multi-tier Selective Coordination: Coordination curves engineered to isolate only the affected branch without de-energizing healthy parallel strings.
- Bi-directional Fault Interruption: Rated for both charge and discharge fault currents (up to 50 kAIC at 1500 Vdc).
- Smart BMS Overcurrent Prediction: Predictive algorithm using historical impedance trends to pre-trip before hard thresholds.
- Arc-Flash Suppression Ready: Integrated arc-flash mitigation with optical detection triggering ultra-fast mechanical or pyrotechnic switches.
- Remote Trip & Reset: EMS-controlled remote opening and manual-remote reset capability for unmanned substations.

COMPLIANCE & STANDARDS

- UL 489 (Molded-Case Circuit Breakers)
- UL 248 (Low-Voltage Fuses)
- IEC 60947-2 (Circuit-breakers)

- IEC 60269-7 (Battery fuses)
- IEEE C37.27 (Application guidelines for low-voltage fuses in BESS)
- NFPA 70 (NEC Article 706 – Energy Storage Systems)

TECHNICAL SPECIFICATIONS

Parameter	Specification
Max DC Voltage	1500 Vdc
DC Short-Circuit Interrupting Rating (I _{cn})	50 kA (standard) / 80 kA (high-break option)
AC Overcurrent Protection (PCS AC side)	100 kAIC @ 480 Vac / 50 kAIC @ 690 Vac
Fuse Type (Module-level)	UL 248-19, 1500 Vdc, aR class, 300 A max rating
Breaker Type (Rack-level)	UL 489, 1500 Vdc, electronically controlled MCCB
Trip Response Time (short-circuit)	< 2 ms (solid-state limiter) / < 10 ms (MCCB)
Selective Coordination Ratio	Fuse-to-Breaker: 1:1.6 (I _{2t})
BMS Overcurrent Alarm Threshold	Adjustable, 1.05x to 1.5x nominal current
Operating Temperature (OCP devices)	-20°C to +55°C (derating above 45°C)

Remote Trip Interface	Dry contact + Modbus RTU/TCP
Arc-Flash Detection Option	Point sensor (UV/IR) or shunt-trip with light pipe

DEPLOYMENT CONSIDERATIONS

String sizing must verify that maximum available fault current from parallel strings and grid-tied PCS does not exceed OCPD interrupting rating. Use dedicated coordination study for systems exceeding 3 MWh. For retrofit or expansion, recalculate prospective fault current at the point of common coupling.



CONCLUSION

The Overcurrent Protection suite meets or exceeds global standards for selective coordination, fault clearing speed, and remote operability, making it a reference design for safe, code-compliant energy storage infrastructure.