

System Overview: Gigavolt Megapack X-7000 Grid-Scale Storage Unit

General Description

The **Gigavolt Megapack X-7000** (Model: **X-7000**) is an industrial-class lithium iron phosphate (LiFePO_4 / LFP) grid-scale battery energy storage system (BESS). Engineered for utility load-leveling, frequency regulation, and microgrid backup operations, each unit delivers a nominal power output of 1,750 kW with an energy capacity of 7,000 kWh (7.0 MWh).

Technical Specifications

- **Model Identifier:** **X-7000**
- **Equipment Series:** Megapack High-Capacity Industrial Series
- **Nominal Output Power:** 1,750 kW
- **Operating DC Voltage Range:** 820 V to 1,150 V nominal (1,250 V max surge)
- **Cell Chemistry:** Prismatic Lithium Iron Phosphate (LiFePO_4)
- **Cooling Architecture:** Dual-loop active liquid glycol-water loop with cold-plate conduction
- **Enclosure Rating:** NEMA 4X / IP66 outdoor rated
- **Maximum Short-Circuit Current:** 35 kA
- **BMS Sampling Frequency:** 100 ms (Voltage, Temperature, Direct Current)

Safety Protocols and Hazard Mitigation

Hazardous Materials Warning

HIGH VOLTAGE DC BUS (UP TO 1250V). ARC FLASH HAZARD.

APPROPRIATE NFPA 70E CATEGORY 4 PPE REQUIRED BEFORE REMOVING

ACCESS PANEL HV-A OR INVERTER BAY ACCESS PANEL INV-01.

Thermal Runaway Mitigation

Although LFP chemistry offers higher thermal decomposition thresholds than nickel-based chemistries, improper thermal management or physical intrusion can trigger an irreversible thermal event.

- 1. **Early Warning Indicators:** Rapid delta in cell temperature ($\Delta T > 2.5\text{ }^{\circ}\text{C/min}$), sudden drop in cell terminal voltage below 2.10 V, or outgassing detected by integrated off-gas sniffer arrays (VOC/CO detection sensors).
- 2. **Automated Isolation:** Upon sensor trip, the Master BMS automatically triggers the primary contactor coil dump, isolates positive and negative busbars via pyrofuses, and commands the high-pressure aerosol fire suppression module (Stat-X aerosol generator).
- 3. **Emergency E-Stop Action:** If smoke, venting, or a continuous audible alarm is present, personnel must depress the external emergency stop (E-STOP) push-button located on the northwest exterior cabinet panel and evacuate to a minimum perimeter distance of 100 meters (330 feet).

Diagnostic Procedures & Troubleshooting Trees

Diagnostic Code Table

Fault Code	Telemetry Name	Severity	Primary Root Cause	Corrective Action
ERR_BMS_701	High Delta Cell Voltage	Critical	Cell degradation, loose interconnect busbar, micro-fractured terminal	Initiate controlled shutdown. Perform manual 4-wire Kelvin resistance test on cell terminals. Replace

Fault Code	Telemetry Name	Severity	Primary Root Cause	Corrective Action
				sub-module if $\Delta V > 120$ mV.
ERR_BMS_708	Thermal Runaway Warning	Fatal	Coolant flow obstruction, pump failure, internal short circuit	System engages auto-deluge. Evacuate area. Do not attempt restart without engineering recertification.
ERR_INV_404	DC Overcurrent Trip	High	Inverter commutation failure, line-to-line bridge breakdown	Inspect Part INV-SCR-9901 thyristor pack and output fuses. Check AC grid synchronization logs.
ERR_COOL_302	Low Coolant Flow Rate	Moderate	Airlock in glycol manifold, strainer clog, impeller cavitation	Inspect flow sensor Part SEN-FL-022. Purge air bubbles using service valve SV-3; top off with 50/50

Fault Code	Telemetry Name	Severity	Primary Root Cause	Corrective Action
				ethylene-glycol mix.

Decision Tree: Addressing Cell Over-Temperature (ERR_BMS_705)

1. **Is the maximum recorded cell temperature $T_{max} \geq 65\text{ }^{\circ}\text{C}$?**
 - **YES:** Immediate emergency shutdown. Check BMS log for thermal acceleration rate. If $dT/dt \geq 2.0\text{ }^{\circ}\text{C/min}$, alert fire marshal and evacuate enclosure.
 - **NO:** Proceed to step 2.
2. **Verify coolant pump operational status via telemetry:**
 - If **pump_rpm** < 1200 RPM while thermal demand is high, inspect coolant circulation pump relay and inline fuse F12.
 - If **pump_rpm** is nominal, check differential pressure gauge across heat exchanger HX-01.
3. **Assess Ambient Temp vs. Operating Load:**
 - If ambient temp > $45\text{ }^{\circ}\text{C}$ and continuous C-rate > 0.8 C, throttle inverter output to 65% capacity until thermal equilibrium (< $42\text{ }^{\circ}\text{C}$) is reached.

Maintenance Schedules & Part Specifications

- **Quarterly:** Visual inspection of external seals, desiccant breather check, torque audit on low-voltage signal wiring harnesses.
- **Bi-Annual:** Coolant conductivity test (< $0.5\text{ }\mu\text{S/cm}$ required). Replace inline filter cartridge (Part Number: **FLT-GLY-701**).
- **Annual:** Infrared thermographic scan across high-voltage busbar connections during peak charge/discharge cycling. Recalibrate voltage sense lines using calibrated Fluke 87V or equivalent.