

Field Incident Investigation Report: SN-X7-0094 Main Contactor Flashover & Bus Fault

Incident Reference: INC-2024-104

Site Location: Rio Bravo Wind & Solar Hybrid Plant (Pecos County, TX)

Equipment Affected: Gigavolt Megapack X-7000 (Unit Serial Number: SN-X7-0094)

Incident Date: September 28, 2024

Lead Investigator: Marcus Vance, Lead Power Electronics Architect

Incident Summary

At 16:04:12 CST on September 28, 2024, Megapack unit SN-X7-0094 suffered an uncontrolled arc flash within Inverter Bay INV-01 during a scheduled high-power ramp from standby to 1,750 kW full export. The high-speed protection circuit tripped upstream 34.5 kV substation recloser REC-34, isolating the unit. Total equipment damage was localized to the DC pre-charge contactor and main line contactor CON-MAIN-800. No personnel injuries occurred.

Sequence of Telemetry Events

- **16:04:10.120** — Remote dispatch commands 100% active power export (1,750 kW).
- **16:04:11.000** — Pre-charge contactor closes. Bus voltage charges from 0 V to 780 V DC.
- **16:04:11.850** — Master BMS detects pre-charge timeout: bus voltage achieved only 780 V instead of required 980 V open-circuit threshold due to a cracked pre-charge resistor RES-PR-50.
- **16:04:11.880** — Fault handling firmware bug in legacy DSP firmware version v2.4.08 failed to abort main contactor engagement. Main contactor CON-MAIN-800 closed against a 200 V differential across terminals.
- **16:04:12.010** — Inrush current exceeded 8,200 A. Contact tips welded, creating localized plasma arc. Telemetry records ERR_INV_404 and ERR_PRE_003 concurrently before communication dropped.

Teardown Findings and Corrective Measures

1. **Component Teardown:** Contactor **CON-MAIN-800** exhibited complete silver-tungsten contact tip erosion and severe vapor deposition across the ceramic arc chute. Resistor **RES-PR-50** was open-circuit due to mechanical vibration cracking of the ceramic core.
2. **Firmware Remediation:** Mandatory firmware update to **v2.4.11-b** instituted globally. The updated firmware implements a hardware-interlocked pre-charge delta abort: if $V_{bus} < 0.95 \times V_{pack}$ at 800 ms, main contactor pull-in coil is permanently locked out.
3. **Mandatory Field Inspection:** All Megapack X-7000 units must inspect pre-charge resistor wirewound terminals during standard quarterly maintenance visits.