

Photovoltaic combiner box branch current is small



Overview

Photovoltaic combiner boxes play a critical role in solar energy systems, acting as the nerve center for current management.

Key Takeaways

Small branch current in a PV combiner box is often caused by shading, sensor misjudgment, wiring issues, or improper fuse sizing, which can reduce power output and trigger false fault reports.

Common Causes



1. **Partial Shading or Obstruction** Branch currents can drop significantly if individual PV modules are partially shaded by trees, dust, bird droppings, or debris. Even a single module obstruction can reduce the branch current to 10–30% of its rated value while adjacent branches remain at full load, creating a strong current imbalance .

2. **Current Sensor Limitations** Traditional current sensors may have insufficient accuracy for low currents. Sensors often struggle to detect currents below 5–10% of the rated value, leading to misjudgment of normal branches as “open circuits” and unnecessary disconnection . Slow response times and poor electromagnetic shielding can further cause false readings during rapid irradiance changes or inverter start/stop events .

3. **Electrical Connection Faults** Loose terminals, poor contact, or cable aging can increase resistance and reduce branch current. Signs include fluctuating current, discoloration, or scorching at connection points. Proper inspection and torque tightening are essential to restore normal current flow .

4. **Fuse or Breaker Issues** Undersized fuses or DC breakers can limit branch current. Each string should have overcurrent protection rated at approximately 1.56 times the string's short-circuit current (I_{sc}) to accommodate environmental and operational variations . Incorrect sizing can cause repeated tripping or reduced current delivery.

5. **String Imbalance** Variations in module performance or mismatched strings can redistribute current unevenly, causing some branches to carry less current. Measuring each string's I_{sc} and comparing with expected values helps identify imbalance issues .

Recommended Actions

- Inspect and clean PV modules to remove shading or debris.
- Verify current sensor accuracy and consider sensors optimized for low-current detection.
- Check all electrical connections, terminals, and cables for tightness, corrosion, or damage.
- Ensure fuses and breakers are correctly rated for each string's maximum current.
- Measure individual string currents to detect imbalances and replace or reconfigure underperforming modules. By addressing these factors, branch currents can be stabilized, reducing false fault reports and improving overall PV system efficiency .

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