

# Power Quality Disturbance Analysis Report

## Event Metadata

| Parameter          | Value                              |
|--------------------|------------------------------------|
| Location           | BUS 11                             |
| Sampling Frequency | 10 kHz (Assumed)                   |
| Nominal Voltage    | 230 V (Assumed System Nominal)     |
| Event Type         | Voltage Sag                        |
| Event Time         | 2025-12-14 21:48:33                |
| Event Duration     | Ongoing                            |
| Amplitude Drop     | Ongoing - Level not yet stabilized |
| Recovery Time      | N/A (Event ongoing)                |

## Summary

At 21:48:33 on December 14, 2025, an ongoing voltage sag was detected at BUS 11 within the Simulink14BusSystem. The voltage level at BUS 11 has dropped and remains unstable, indicating a persistent disturbance. The exact amplitude drop and recovery time are currently undetermined as the event is still active.

## Technical Analysis

- **Sag Severity:** Potentially severe. An ongoing sag indicates a persistent fault or sustained overload, posing a significant risk to connected equipment and system stability.
- **Voltage Deviation:** Currently unstable and undetermined. Continuous monitoring is essential to quantify the deviation.
- **Likely Causes:** Given the location at BUS 11 and its connections in the power system schematic:
  - **Fault within the Rectifier System:** BUS 11 serves as the AC bus for a rectifier system (DIODEBRIDGE, DCLINKCAP, DCLOAD). A persistent fault or excessive current draw within these rectifier components or the DC load itself could be causing the ongoing sag.
  - **Persistent Line Fault:** A sustained fault on LINE10\_11 (connecting to BUS 10) or LINE11\_12 (connecting to BUS 12) could be drawing excessive current and causing the voltage sag at BUS 11.
  - **Downstream Fault/Overload:** A persistent fault or significant overload at a downstream bus (e.g., BUS 12, BUS 13, BUS 14, where loads like LOAD12, LOAD13, LOAD14 are connected) could propagate upstream to BUS 11.
  - **Equipment Malfunction:** A failure or malfunction of equipment directly connected to BUS 11 (e.g., protection relays, measurement devices) that leads to a sustained low impedance path.
- **System Impact:**
  - **Rectifier and DC Load Disruption:** The rectifier system connected to BUS 11 will be directly affected, potentially leading to malfunction, shutdown, or damage to the DIODEBRIDGE, DCLINKCAP, and especially the DCLOAD.
  - **Propagation to Adjacent Buses:** The sag could propagate to adjacent buses (BUS 10 and BUS 12), affecting their stability and potentially disrupting loads like LOAD10 and LOAD12.
  - **Stress on System Components:** Sustained undervoltage and potentially overcurrent conditions will stress LINE10\_11 and LINE11\_12, as well as switchgear and transformers connected to BUS 11.
  - **Overall System Instability:** A prolonged and unmitigated sag can lead to wider system instability or even cascade failures if not addressed promptly.
- **Standards Compliance:** An ongoing voltage sag, by its nature, typically falls outside the acceptable transient limits defined by standards like IEEE Std 1159 for momentary

disturbances. Immediate action is required to bring the system back within operational parameters.

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## Recommendations

### Immediate Actions

- **Isolate and Locate Fault:** Immediately use real-time measurements (VM11, IM11) to pinpoint the source of the sag. Prioritize checking the rectifier components and connected lines (LINE10\_11, LINE11\_12).
- **Rectifier System Inspection:** Perform an urgent inspection of the DIODE\_BRIDGE, DC\_LINK\_CAP, and DC\_LOAD connected to BUS 11 for signs of fault, overload, or malfunction.
- **Line Inspection:** Dispatch personnel to physically inspect LINE10\_11 and LINE11\_12 for any visible faults or abnormal conditions.
- **Operational Adjustments:** If the fault cannot be immediately located or isolated, consider controlled shedding of loads or temporary isolation of BUS 11 if possible, to prevent further propagation and protect equipment.
- **Notify Operators:** Alert all relevant system operators and maintenance teams about the ongoing critical event.

### Preventive Measures

- **Enhanced Protection Coordination:** Review and optimize the protection settings and coordination for LINE10\_11, LINE11\_12, and the rectifier circuit to ensure faster and more selective fault isolation.
  - **Local Voltage Support:** Evaluate the feasibility of installing a dedicated voltage support device (e.g., Static Var Compensator (SVC), STATCOM, or a Dynamic Voltage Restorer (DVR)) at or near BUS 11 to mitigate future sags, especially considering the critical rectifier load.
  - **Rectifier System Hardening:** Implement robust overcurrent and undervoltage protection for the rectifier and dc\_load. Consider adding ride-through capabilities (e.g., larger DC link capacitors or auxiliary power) for critical DC loads.
  - **Improved Monitoring:** Deploy more granular and high-speed monitoring at BUS 11 and its immediate vicinity to provide better diagnostics for future events.
  - **Fault Location System:** Investigate and implement advanced fault location systems for transmission lines to reduce fault identification time.
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### AI Remarks

The ongoing voltage sag at BUS 11 is a critical power quality disturbance requiring immediate and decisive action. Unlike transient events, a persistent sag indicates a fundamental issue that can lead to severe equipment damage, operational downtime for the connected rectifier system and its DC load, and potentially wider system instability. The recommendations provided are specifically tailored to the Simulink\_14Bus\_System schematic, focusing on the rectifier and connected lines at BUS 11. Prioritizing fault identification and isolation is paramount to restoring system stability and preventing further complications.