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White Paper

Grid Resilience in the Renewable Era: Navigating NERC PRC-028-1 Standards

What is NERC PRC-028-1?

As more Inverter-Based Resources (IBRs)—such as solar, wind, and battery storage—are integrated into the Bulk Electric System (BES), ensuring reliable performance during grid disturbances has become increasingly important. Events like the Blue Cut Fire (2016), Canyon 2 Fire (2017), and Odessa disturbances (2021 and 2022) revealed a significant gap: many IBR facilities lacked disturbance monitoring equipment, making it difficult to assess their performance during system faults. This absence of high-quality data hindered event analysis, model validation, and the development of mitigation strategies.

To address these challenges, the North American Electric Reliability Corporation (NERC) developed PRC-028-1, a reliability standard focused on improving disturbance monitoring and reporting for IBRs. The standard applies to generator owners of BES IBRs, as well as certain non-BES IBRs rated 20 MVA or higher and connected at 60 kV or above. PRC-028-1 mandates the use of specific monitoring tools—such as sequence of events recording, fault recording, and dynamic disturbance recording—to capture essential data, improve coordination, and strengthen BES reliability.

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R1 – Sequence of Events Recording (SER)

Generator owners must record the status of key equipment, including breakers for main transformers, collector buses, and reactive power devices. For IBRs placed in service after the standard's effective date, sequence of events recording must also capture fault alarms, fault codes, and the status of voltage and frequency ride-through modes during disturbances. Existing IBRs must provide these recordings if the capability exists. Sequence of events recording data offers critical insight into the sequence and timing of actions during a system event.

R2 and R3 – Fault Recording (FR) Data Requirements

Fault recording systems must collect electrical measurements at critical points, such as the high side of the main power transformer, collector feeder breakers, and dynamic reactive resources. These measurements must include voltage, current, real power, and reactive power. Triggered during faults, this data helps validate how IBRs perform under abnormal conditions and supports accurate root cause analysis.

Fault recordings must meet minimum technical standards: 64 or more samples per electrical cycle, at least two cycles of pre-trigger data, and a minimum of two seconds total recording time. Trigger conditions must include overcurrent on grounded conductors, sudden voltage fluctuations, and frequency anomalies. These specifications ensure that recordings are complete and actionable.

R4 and R5 – Continuous Dynamic Disturbance Recording (DDR)

Dynamic disturbance recording systems must continuously monitor and record electrical data—including voltage, current, real power, reactive power, and frequency—at the high side of the main transformer. This long-term recording helps identify slower, evolving system issues and gives planners and engineers a broader view of IBR performance during extended disturbances.

Dynamic disturbance recording systems must sample data at a minimum of 960 times per second and record it at least 60 times per second. This high resolution is necessary to capture rapid changes in electrical behavior and supports both real-time monitoring and detailed event review.

R6 – Time Synchronization

All sequence of events recording, fault recording, and dynamic disturbance data must be time-aligned to Coordinated Universal Time (UTC). Sequence of events and fault recording data must have timestamps accurate within ±1 millisecond, while IBR system data must be accurate within ±100 milliseconds. This level of synchronization enables accurate cross-site comparisons and event reconstruction across the BES.

R7 – Data Retrieval and Submission

Generator owners must retain recorded data for at least 20 calendar days and must submit it within 15 calendar days upon request from reliability coordinators or other applicable entities. Data must follow accepted formats like COMTRADE or COMNAME to ensure compatibility with analysis software and regional reporting tools.

R8 – Recording Capability Failures

If any sequence of events recording, fault recording, or dynamic disturbance data system becomes nonfunctional, the generator owners must restore it within 90 days. If that's not feasible, a Corrective Action Plan (CAP) must be submitted to the Regional Entity. This ensures continuous readiness and minimizes data gaps during future events.

PRC-028-1 establishes a clear framework for how IBR facilities must monitor and report system disturbances. By requiring robust data collection, precise synchronization, and prompt reporting, the standard ensures that IBRs can be effectively integrated into the BES while maintaining system stability. As the grid continues its transition toward cleaner energy sources, PRC-028-1 plays a crucial role in enhancing the reliability and resilience of the North American power system.

Who is SynchroGrid?

SynchroGrid is a pioneering engineering consulting firm that specializes in system protection solutions for generation, transmission, and distribution utilities. Our innovative engineering services encompass an array of offerings, including NERC compliance, relay setting development, protection and control design, substation design, and tailored automation solutions, among others.

With a team of seasoned engineers, SynchroGrid remains at the forefront of industry advancements, ensuring our clients' compliance with the latest regulatory requirements. We are dedicated to enhancing grid reliability while mitigating the risk of substantial fines for our clients. Our expertise spans across various NERC standards, from PRC-002 to PRC-027, providing support to utilities seeking to uphold regulatory standards and maintain operational excellence.

***References**:*

https://www.nerc.com/pa/Stand/Reliability%20Standards/PRC-028-1.pdf