

**A. Introduction**

1. **Title:** Disturbance Monitoring and Reporting
2. **Number:** PRC- 002- 01
3. **Purpose:** To establish requirements for recording and reporting disturbance data to facilitate analysis of Disturbances. Disturbance data shall include sequence of events (SOE) data, fault recording (FR) data, and dynamic disturbance recording (DDR) data.
4. **Applicability:**
  - 4.1 Transmission Owners
  - 4.2 Generator Owners
5. **Effective Date:** TBD

**B. Requirements**

**R1** Transmission Owners and Generator Owners, ~~based on equipment ownership,~~ shall ~~obtain~~ record or have a process in place to derive SOE data for the **data that represents** change in circuit breaker ~~in~~ position (open/close ~~position~~) ~~of each of the following circuit breakers:~~

**At for:**

- Circuit breakers 200 kV and above ~~at~~ ~~circuit breakers 200 kV or above~~
  - Generator circuit breakers for generators with a nameplate rating of 500 MVA or higher
  - Circuit breakers on tie lines 100 kV or above between Balancing Authority Areas
- for the circuit breakers in the following facilities:

- Substations **and switching stations** containing any combination of three or more elements consisting of transmission lines (operated at 200 kV or above) and transformers (having primary and secondary voltage ratings of 200 kV or above),
- Circuit breakers on high side of generator step-up transformers at Substations connected at 200 kV or above through generating unit step up transformer(s) to either a generating plant having a single generating unit of 500 MVA or higher nameplate rating or an aggregate plant total nameplate capacity of 1500 MVA or higher, and
- Circuit breakers on tie lines 100 kV and above at Substations ~~containing one or more tie lines~~ between Balancing Authorities Areas ~~at 100 kV or above~~ *{Violation Risk Factor: Lower}*

**R2** Transmission Owners and Generator Owners shall record data or have a process in place to derive the time stamp to within 4 milliseconds of the input received for the change in circuit breaker position (open/close) for the circuit breakers identified in R1.

**R3 (Concept: Word change required; Common requirement for all 3 DMEs)** Transmission Owners and Generator Owners shall use internal clocks that are synchronized to within 2 milliseconds of UTC with hour offset as necessary

~~shall obtain [MSOffice1] time stamp circuit breaker position data for circuit breakers identified in R.1 to designate the time that an input is received to within 4 ms (or less) of change of position.~~

~~**R3** Transmission Owners and Generator Owners shall time stamp and synchronize the required circuit breaker position data from a time source having a resolution of 1 millisecond.~~

~~**R4** Transmission Owners and Generator Owners shall monitor circuit breaker position to within 2 milliseconds or less of Universal Coordinated Time scale (UTC) with hour offset defined.~~

**R45 (Concept; word change reqd; common req.)** Transmission Owners and Generator Owners shall retain circuit breaker position change data retrievable for ten calendar days for each Disturbance [MSOffice2]

- R2** Transmission Owners shall record or have a process in place to derive the following FR data:
- The three phase to neutral voltages on the monitored line or bus, including separate sections of a straight bus if the bus is capable of splitting. On ring busses only the voltages of bus sections connected to transmission lines need to be monitored. On breaker-and-a-half arrangements only the outer bus voltages need to be monitored.
  - The three phase currents and the residual or neutral currents of each monitored line and transformer.
  - Polarizing currents, if used

for:

~~Transmission Owners shall obtain FR data for the following:~~

- ~~• \*~~ Transmission lines operated at 200 kV or above, but if fault recording equipment is installed at the remote terminal of the transmission line this may be considered optional
- 
- Transmission buses operated at 200 kV or above
- \*
- Transformers having primary and secondary voltage rating of 200 kV or above

▪ **R2.1**

Located in substations or switching stations having any of the following attributes:

- Any combination of three or more elements consisting of transmission lines (operated at 200 kV or above) and transformers (having primary and secondary voltage ratings of 200 kV or above)
- Transmission substation connected at 200 kV or above through generating unit step up transformer(s) to either a generating plant having a single generating unit of MVA or higher nameplate rating or an aggregate plant total nameplate capacity of MVA or higher
- Tie lines between Balancing Authorities Areas

**R2.1.2.1**

**R2.1.2.2** Generator Owners shall obtain FR data sufficient to determine the following quantities:<sup>[MSOffice3]</sup>

- \* The three phase to neutral voltages on the monitored line or bus, including separate sections of a straight bus if the bus is capable of splitting. On ring busses only the voltages of bus sections connected to transmission lines need to be monitored. On breaker-and-a-half arrangements only the outer bus voltages need to be monitored.
- \* The three phase currents and the residual or neutral currents of each monitored line and transformer.
- \* Polarizing currents, if used
- \* Frequency
- \* **Active power and reactive power.**

for GSU transformers connected at 200 kV or above. The Generator Owners shall obtain the FR data for these transformers at either the lower or higher voltage level, with the voltages and currents obtained at the same voltage level.

**R2.3** The Transmission Owners and Generator Owners shall ensure that the FR data obtained conform to the following:

- \* the FR data shall include at least three cycles of pre-trigger data.
- \* the FR data shall include either of the following:

- A post trigger record length of at least 50 cycles, or
- A duration to include the first three cycles of an event and the final cycle of an event, using either a single continuous record or multiple triggered records

\* the FR data shall be recorded with a minimum recording rate of 16 samples per cycle.

\* **the** FR data recording triggering parameters shall include one or more of following:

- negative sequence voltage
- negative sequence current,
- zero sequence current (tertiary or residual),
- under voltage,
- over voltage,
- over current
- zero sequence voltage

and one or more of the following:

- Activation of DC trip busses,
- circuit breaker contact opening,
- protective relay operation

**R2.1 The Transmission Owners and Generator Owners shall obtain FR data from sources** synchronized to 2 milliseconds or less of Universal Coordinated Time scale (UTC) with hour offset designated

**R2.2 The Transmission Owners and Generator Owners shall** retain FR data retrievable for ten calendar days for each Disturbance

**R3** Transmission Owners and Generator Owners shall record DDR data (either directly or sufficient to derive): the following:

\* Bus Voltage (at least one per voltage level of 200KV or above at each DDR location)

\* Frequency (at least one per DDR location)

\* Line Current

\* Power and Reactive Power (MW and MVAR) flows expressed on a three-phase basis (per each monitored element) [*Violation Risk Factor: Lower*]

for the following locations either directly or derivable from data available one or two transmission substations or switching stations away at a common voltage level:

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- \* Transmission substations or switching stations connected at 200 kV or above to a single generating unit of 850 MVA or higher nameplate rating or multiple generating units having a total nameplate capacity of 1500 MVA or higher.
- \* Transmission substations or switching stations having a total of 7 or more transmission lines connected at 200 kV or above.
- \* Transmission substations or switching stations connecting to another Balancing Authority or Reliability Coordinator at 345 kV or above.
- \* All elements at 345 kV or above associated with IROLs.
- \* At least one location within an area that has an Under-Voltage Load Shedding program installed to which NERC PRC-021 applies.

for at least one phase of the following system elements in the above locations

**R4.2.1** All transmission lines connected at 200KV or above

**R4.2.2** Connections to all GSU transformers connected at 200KV or above

**R4.2.3** All other transformers with both primary and secondary windings connected at 200KV or above

**R3.4** The Transmission Owners and Generator Owners shall obtain DDR data that conform to the following technical specifications:

- \* . Voltage and/or current recordings shall be from the same phase(s).
- \*DDR Data from any new location shall be continuously recorded.
- \*DDR Data from existing locations which do not have continuous recording capability shall be triggered and recorded according to the following:
  - \* for rate-of-change of frequency.
  - \* data available for oscillation triggers shall be set to trigger for low frequency oscillations in 0.1 to 4 Hz range.
  - \* data record lengths shall be not less than three minutes.
  - \* data sampling rate shall be at least 960 samples per second

\* data shall record the RMS value of electrical quantities at a rate of at least 6 times per second.

**R3.5 The Transmission Owners and Generator Owners shall obtain DDR data from sources** synchronized to 2 milliseconds or less of Universal Coordinated Time scale (UTC) with hour offset designated  
**R3.6 The Transmission Owners and Generator Owners shall** retain DDR data retrievable for ten calendar days for each Disturbance

**R4** Transmission Owners and Generator Owners shall meet the following Retrieval and Reporting requirements [*Violation Risk Factor: Lower*]

**R4.1 and R4.2 to be discussed in Tampa**

**R4.3**

**R4.4** The Transmission Owner and Generation Owner shall provide all FR data, SOE data, or DDR data to the Regional Entity (RE) or the Reliability Coordinator (RC) within 20 business days of a request or power system faults and protection system operations.

**R4.5** The Transmission Owner and Generation Owner shall retain all data retrieved and provided to the Regional Entity (RE) or Reliability Coordinator (RC) in accordance with R5.1 and R5.2 at least until the end of the third calendar year following the event.

**RXX** The Transmission Owner and Generator Owner shall, upon request, furnish the data to the RE and RC in a format such that any software system capable of viewing and analyzing COMTRADE (IEEE Std. C37.111-1997 or successor) files may be used to process and evaluate the data.

**R4.5.1 The Transmission Owners and Generator Owners shall report, along with the SOE data, any** known delays in interposing relays

**R4.6** The Transmission Owners and Generator Owners shall name data files reported to the RE and RC in conformance with IEEE C37.232, Recommended Practice for Naming Time Sequence Data Files.

**R5** The Transmission Owner and Generator Owner shall each maintain, and report to its RE on request, the following data on the sources of data:

- \* Type of data source (e.g., sequence of event recorder, fault recorder, or dynamic disturbance recorder, other data from which the values may be derived).
- \* Make and model of equipment.
- \* Installation location.

- \* Monitored elements, such as transmission circuit, bus section, etc.
- \* Monitored devices, such as circuit breaker, disconnect status, alarms, etc.
- \*Monitored electrical quantities, such as voltage, current, etc.

### C. Measures

- M2** Evidence that SOE data is obtained or derived for all required locations and conforms to the minimum requirements. (R2)
- M3** Evidence that **FR data** is obtained or derived for all required locations and conforms to the minimum requirements. (R3)
- M4** Evidence that DDR data is obtained or derived for all required locations and conforms to the minimum requirements. (R4)
- M5** Evidence that required SOE data, FR data, and DDR data is obtained, retained and provided in accordance with the reporting requirements. (R5)

### D. Compliance

1. Violation Severity Levels

**E. Definitions**

**The following are definitions of terms used in this Standard**  
**The following definitions have been extracted from IEEE standards.**

**Substation** - As defined by the IEEE C2-2002, (National Electric Safety Code) “An enclosed assemblage of equipment, e.g. switches, circuit breakers, buses and transformers, under control of qualified persons, through which electric energy is passed for the purpose of switching or modifying its characteristics.”

**F. IntraRegional Differences**

None

**G. Notes****Version History**

<b>Version</b>	<b>Date</b>	<b>Action</b>	<b>Change Tracking</b>
1 <sup>st</sup> Draft	8/09/07	Initial draft from first meeting	
2 <sup>nd</sup> Draft	8/27/07	E-Mailed changes	
Draft 2.03	9/26/07	Additional e-mailed changes	
Draft 2.04	9/27/07	Changes made during the 9/27/07 conference call	