NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

Project 2007-11 – Disturbance Monitoring
PRC-002-2 – Disturbance Monitoring and Reporting Requirements

Mapping Document for PRC-018-1 to PRC-002-2 and PRC-002-1 to PRC-002-2

PRC-002-2 addresses the recording (data), not "how" the data is recorded, thus eliminating the complications that arise from the inherent differences between regional power systems. PRC-018-1 and PRC-002-1 deal with equipment, PRC-002-2 deals with recording. By specifying ~~recording~~ data instead of equipment, PRC-002-2 governs the practical capturing of abnormal event data on the BES.

PRC-018-1 Requirements reference PRC-002-1 which requires PRC-018-1 Requirements to be either retired or covered in PRC-002-2.

~~As used herein, the acronym SER is Sequence of Events Recording, the acronym FR is Fault Recording, and the acronym DDR is Dynamic Disturbance Recording.~~

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
R1. Each Transmission Owner and Generator Owner required to install DMEs by its Regional Reliability Organization (reliability standard **PRC-002 Requirements 1-3**) shall have DMEs installed that meet the following requirements: R1.1. Internal Clocks in DME devices shall be synchronized to **within 2 milliseconds** or less of Universal Coordinated Time scale (UTC) R1.2. Recorded data from each Disturbance shall be **retrievable for ten calendar days**.	**R10**. Each Transmission Owner and Generator Owner shall time synchronize all SER and~~,~~ FR and DDR data for the BES bus buses identified per Requirement R1 and DDR data for the BES Elements identified per Requirement R5 that meet the following:~~to within ± 2 milliseconds of Coordinated Universal Time (UTC), time stamped with or without a local time offset.~~ *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* *10.1 Synchronization to Coordinated Universal Time (UTC), with or without a local time offset.* *10.2 Synchronized device clock accuracy within ± 2 milliseconds of UTC.* **R11.** Each Transmission Owner and Generator Owner shall provide SER, FR, and DDR data for the BES bus locations identified per Requirement R1 and BES Elements identified per Requirement R5 to the Reliability Coordinator, Regional Entity, or NERC: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **11.1.** The recorded data will be provided within 30 calendar days of a request. **11.2.** The recorded data will be retrievable for the period of 10 calendar days preceding a request. **11.3.** SER data will be provided in ASCII Comma Separated Value (.CSV) format following Attachment 2. **11.4.** FR and DDR data will be provided in electronic files that are formatted in conformance with C37.111, ~~(C37.111-2013 or later)~~ IEEE Standard for Common Format for Transient Data Exchange (COMTRADE), revision C37.111.1999 or later ~~formatted files~~.

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	11.5. Data files will be named in conformance with C37.232, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME), revision C37.232-2011 or later.
Notes: PRC-018-1, Requirement R1 is covered in PRC-002-2, Requirements R10 and R11. PRC-018-1 addresses the equipment used for Disturbance monitoring data recording, PRC-002-2 addresses the recorded data. Technological advances made in the types of equipment used to record power system data have made it more effective to direct PRC-002-2 at the recording, not the equipment. Time synchronization and having the data retrievable for 10 days are general parameters that facilitate data analysis. PRC-002-1, Requirement R1 is covered in PRC-002-2, Requirement R11.	
R2. The Transmission Owner and Generator Owner shall each **install DMEs in accordance with** its Regional Reliability Organization's installation requirements (reliability standard **PRC-002 Requirements 1 through 3**). **PRC-002-1** R1. The Regional Reliability Organization shall establish the following installation requirements for **sequence of event**	**R1.** Each Transmission Owner ~~shall identify BES buses for which sequence of events recorder (SER) and fault recorder (FR) data is required by using the methodology in PRC-002-2, Attachment 1, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require SER data and/or FR data, and reevaluate the identified buses at least once every five calendar years.~~ [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 1.1. Identify BES buses for which sequence of events recording (SER) and fault recording (FR) data is required by using the methodology in PRC-002-2, Attachment 1; 1.2. Notify other owners of BES Elements connected to those BES buses, if any, within

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
recording: R1.1. Location, monitoring and recording requirements, including the following: R1.1.1. Criteria for equipment location (e.g., by voltage, geographic area, station size, etc.). R1.1.2. Devices to be monitored R2. The Regional Reliability Organization shall establish the following installation requirements for **fault recording**: R2.1.Location, monitoring and recording requirements, including the following: R2.1.1. Criteria for equipment location (e.g., by voltage, geographic area, station size, etc.). R2.1.2. Elements to be monitored at each location. R2.1.3. Electrical quantities to be recorded for each monitored element shall be sufficient to determine the following: R2.1.3.1. Three phase to neutral voltages. R2.1.3.2. Three phase currents and neutral currents. R2.1.3.3. Polarizing currents and voltages, if used. R2.1.3.4. Frequency. R2.1.3.5. Megawatts and megavars. R2.2.Technical requirements, including the following:	90-calendar days of completion of Part 1.1 that those BES Elements require SER data and/or FR data; 1.3. Re-evaluate all BES buses at least once every five calendar years in accordance with Part 1.1 and notify other owners, if any, in accordance with Part 1.2, and implement the reevaluated list of BES buses as per the Implementation Plan. **R2.** Each Transmission Owner and Generator Owner shall have SER data for circuit breaker position (open/close) for each circuit breaker itthey owns connected directly to the BES buses identified per Requirement R1 and associated with the BES Elements at those BES buses identified per Requirement R1. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] **R3.** Each Transmission Owner and Generator Owner shall have FR data to determine the following electrical quantities for each triggered FR for at the BES Elements itthey owns connected to the BES buses identified per Requirement R1: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 3.1 Phase-to-neutral voltages for each phase of each specified line or BES bus. 3.2 Each phase current and the residual or neutral current for the following BES Elements: 3.2.1. Transformers that have a low-side operating voltage of 100kV or above. 3.2.2. Transmission lLines.

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
R2.2.1.Recording duration requirements. R2.2.2. Minimum sampling rate of 16 samples per cycle. R2.2.3. Event triggering requirements. R3. The Regional Reliability Organization shall establish the following installation requirements for **dynamic Disturbance recording**: R3.1. Location, monitoring and recording requirements including the following: R3.1.1.Criteria for equipment location giving consideration to the following: -Site(s) in or near major load centers -Site(s) in or near major generation clusters -Site(s) in or near major voltage sensitive areas -Site(s) on both sides of major transmission interfaces -A major transmission junction -Elements associated with Interconnection Reliability Operating Limits -Major EHV interconnections between control areas -Coordination with neighboring regions within the interconnection R3.1.2. Elements and number of phases to be monitored at each location. R3.1.3. Electrical quantities to be recorded for each monitored element	R4. Each Transmission Owner and Generator Owner shall have FR data as specified in Requirement R3 that meets the following: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **4.1** A single record or multiple records that include: • A pre-trigger record length of at least two cycles and a total~~post-trigger~~ record length of at least 30 cycles for the same trigger point. • At least two cycles of the pre-trigger data, the first three cycles of the fault, and the final cycle of the fault as seen by the fault recorder. **4.2.** A minimum recording rate of 16 samples per cycle. **4.3.** Trigger settings for at least the following: **4.3.1.** Neutral (residual) overcurrent. **4.3.2.** Phase undervoltage or overcurrent. R5. Each Responsible Entity shall: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **5.1** Identify BES Elements for which dynamic Disturbance recording (DDR) data is required, including the following: **5.1.1** Generating resource(s) with: **5.1.1.1** Gross individual nameplate rating greater than or equal to 500 MVA. **5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
shall be sufficient to determine the following: R3.1.3.1. Voltage, current and frequency. R3.1.3.2. Megawatts and megavars. R3.2. Technical requirements, including the following: R3.2.1. Capability for continuous recording for devices installed after January 1, 2009. R3.2.2. Each device shall sample data at a rate of at least 960 samples per second and shall record the RMS value of electrical quantities at a rate of at least 6 records per second.	than or equal to 1000 MVA. **5.1.2** Any one BES Element that is part of a stability (angular or voltage) related System Operating Limit (SOL). **5.1.3** Each terminal of a high voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA, on the alternating current (AC) portion of the converter. **5.1.4** One or more BES Elements that are part of an Interconnection Reliability Operating Limits (IROL). **5.1.5** Any one BES Element within a major voltage sensitive area as defined by an area with an in-service undervoltage load shedding (UVLS) program. **5.2** Ensure a minimum DDR coverage, inclusive of those BES Elements identified in Part 5.1, of at least: **5.2.1** One BES Element **5.2.2** One BES Element per 3,000 MW of the Responsible Entity's historical simultaneous peak System Demand. **5.3** Notify all owners of identified BES Elements, within 90-calendar days of completion of Part 5.1, that their respective BES Elements require DDR data when requested. **5.4** Reevaluate all BES Elements at least once every five calendar years in accordance with Parts 5.1 and 5.2 and notify owners in accordance with Part 5.3, and implement the reevaluated list of BES Elements as per the Implementation Plan. ~~R5. Each Responsible Entity (Planning Coordinator or Reliability Coordinator, as applicable)~~

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	~~shall identify BES Elements for which dynamic disturbance recorder (DDR) data is required, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require DDR data, and reevaluate the identified buses at least once every five calendar years. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ ~~**5.1.** The BES Elements shall include the following:~~ ~~**5.1.1.** Generating resource(s) with:~~ ~~**5.1.1.1.** Gross individual nameplate rating greater than or equal to 500 MVA.~~ ~~**5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000MVA.~~ ~~**5.1.2.** Any one BES Element associated with major transmission interfaces, as defined by the Responsible Entity. Selection of major transmission interfaces should consider the following guidelines:~~ ~~• Stability related interfaces or other significant Flowgates in the NERC Book of Flowgates for the Eastern Interconnection or~~ ~~• Transfer Paths in the Western Interconnection Path Rating Catalog or~~ ~~• Voltage stability limited transfer paths or load serving area or~~ ~~• Interfaces between Balancing Authority Areas or~~ ~~• Areas of significant congestion, thermal violation history, or relatively low Available Transfer Capability (ATC)~~

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	~~**5.1.3.** Each terminal of a high-voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA on the alternating current (AC) portion of the converter.~~ ~~**5.1.4.** One or more BES Elements associated with Interconnection Reliability Operating Limits.~~ ~~**5.1.5.** Any one BES Element within a major voltage sensitive area with an in-service undervoltage load shedding (UVLS) program.~~ ~~**5.2.** The BES Elements shall include a minimum of:~~ ~~**5.**2.1 One BES Element~~ ~~**5.**2.2 One additional BES Element per each additional 3,000 MW of its historical peak system Demand.~~ R6. Each Transmission Owner shall have DDR data to determine the following electrical quantities for each BES Element it owns for which it received notification as identified in Requirement R5~~, to determine the following electrical quantities~~: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* 6.1 One phase-to-neutral or positive sequence voltage. 6.2 The phase current for the same phase at the same voltage corresponding to the voltage in Requirement R6, Part 6.1, or the positive sequence current. 6.3 Real Power and Reactive Power flows expressed on a three-phase basis corresponding to all circuits where current measurements are required.

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	6.4 Frequency of any one of the voltage(s) in Requirement R6, Part 6.1. R7. Each Generator Owner shall have DDR data to determine the following electrical quantities for each BES Element it owns for wich it received notification as identified inper Requirement R5~~, to determine the following electrical quantities~~: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 7.1. One phase-to-neutral, phase-to-phase, or positive sequence voltage at either the generator step-up (GSU) transformer high-side or low-side voltage level. 7.2. The phase current for the same phase at the same voltage in Requirement R7, Part 7.1, phase current(s) for any phase-to-phase voltages, or positive sequence current. 7.3. Real Power and Reactive Power flows expressed on a three-phase basis corresponding to all circuits where current measurements are required. 7.4. Frequency of at least one of the voltages in Requirement R7, Part 7.1. R8. Each Transmission Owner and Generator Owner that is responsible for DDR data for the BES Elements identified in~~as per~~ Requirement R5 shall have continuous data recording and storage. If the equipment was installed prior to the effective date of this standard and is not capable of continuous recording, triggered records must meet the following: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* 8.1. Triggered record lengths of at least three minutes. **8.2.** At least one of the following three triggers:

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	• Off nominal frequency trigger set at: o Eastern Interconnection — Low: <59.75 Hz; High: >61.0 Hz o Western Interconnection — Low: <59.55 Hz; High: >61.0 Hz o ERCOT Interconnection — Low: <59.35 Hz; High: >61.0 Hz o Hydro-Quebec Interconnection — Low: <58.55 Hz; High: >61.5 Hz • Rate of change of frequency trigger set at: o Eastern Interconnection — < -0.03125 Hz/sec; > 0.125 Hz/sec o Western Interconnection — < -0.05625 Hz/sec; > 0.125 Hz/sec o ERCOT Interconnection — < -0.08125 Hz/sec; > 0.125 Hz/sec o Hydro-Quebec Interconnection — < -0.18125 Hz/sec; > 0.1875 Hz/sec • Undervoltage trigger set no lower than 85% of normal operating voltage for a duration of 5 seconds R9. Each Transmission Owner and Generator Owner responsible for DDR data for the BES Elements identified in Requirement R5 shall have DDR data that meets ~~, which conform to~~ the following technical specifications: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	9.1 Input sampling rate of at least 960 samples per second. 9.2 Output recording rate of electrical quantities of at least 30 times per second.
Notes: PRC-018-1, Requirement R2 and PRC-002-1 Requirements R1-R3 are covered in PRC-002-2, Requirements R1-R9. PRC-018-1, Requirement R2 references PRC-002-1 Requirements R1-R2. PRC-002-1, Requirements R1-R3 reference equipment installation requirements for FR, SER, and DDR. The technical parameters of PRC-002-2 pertain to the characteristics and content of the recordings that are needed to facilitate event analysis.	
R3. The Transmission Owner and Generator Owner shall each maintain, and report to its Regional Reliability Organization on request, the following data on the DMEs installed to meet that region's installation requirements (reliability standard PRC-002 Requirements1.1, 2.1 and 3.1): R3.1. Type of DME (sequence of event recorder, fault recorder, or dynamic disturbance recorder). R3.2. Make and model of equipment.	None.

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
R3.3. Installation location. R3.4. Operational status. R3.5. Date last tested. R3.6. Monitored elements, such as transmission circuit, bus section, etc. R3.7. Monitored devices, such as circuit breaker, disconnect status, alarms, etc. R3.8.Monitored electrical quantities, such as voltage, current, etc.	
Notes: PRC-018-1, Requirement R3 is not covered in PRC-002-2. PRC-018-1 Requirement R3 refers to equipment and therefore is not mapped to PRC-002-2 which deals with recorded data and not equipment.	

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
R4. The Transmission Owner and Generator Owner shall each **provide Disturbance data** (recorded by DMEs) in accordance with its Regional Reliability Organization's requirements (reliability standard **PRC-002 Requirement 4**). **PRC-002-1** R4. The Regional Reliability Organization shall establish requirements for facility owners to report Disturbance data recorded by their DME installations. The Disturbance data reporting requirements shall include the following: 4.1. Criteria for events that require the collection of data from DMEs. 4.2. List of entities that must be provided with recorded Disturbance data. 4.3. Timetable for response to data request. 4.4. Provision for reporting Disturbance data in a format which is capable of being viewed, read and analyzed with a generic COMTRADE analysis tool.	**R11.** Each Transmission Owner and Generator Owner shall provide SER, FR, and DDR data for the BES bus locations identified per Requirement R1 and BES Elements identified per Requirement R5 to the Reliability Coordinator, Regional Entity, or NERC: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **11.1.** The recorded data will be provided within 30 calendar days of a request. **11.2.** The recorded data will be retrievable for the period of 10 calendar days preceding a request. **11.3.** SER data will be provided in ASCII Comma Separated Value (.CSV) format following Attachment 2. **11.4.** FR and DDR data will be provided in electronic files that are formatted in conformance with C37.111, IEEE Standard for Common Format for Transient Data Exchange (COMTRADE), revision C37.111.1999 or later. **11.5.** Data files will be named in conformance with C37.232, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME), revision C37.232-2011 or later. ~~**R11.** Each Transmission Owner and Generator Owner shall provide SER, FR, and DDR data for the BES bus locations identified per Requirement R1 and BES Elements identified per Requirement R5 to the Reliability Coordinator, Regional Entity, or NERC: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ ~~**11.1.** The recorded data will be provided within 30 calendar days of a request.~~

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
4.5. Naming of data files in conformance with the IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files. 4.6. Data content requirements and guidelines.	~~**11.2.** The recorded data will be retrievable for the period of 10 calendar days preceding a request.~~ ~~**11.3.** SER data will be provided in Comma Separated Value (.CSV) format following Attachment 2.~~ ~~**11.4.** FR and DDR data will be provided in electronic C37.111, (C37.111-2013 or later) IEEE Standard for Common Format for Transient Data Exchange (COMTRADE), formatted files.~~ ~~**11.5.** Data files will be named in conformance with C37.232, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME).~~

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
Notes: PRC-018-1, Requirement R4 references PRC-002-1 Requirement R4 which is covered is PRC-002-2, Requirement R11.	
R5. The Transmission Owner and Generator Owner shall each **archive all data** recorded by DMEs for Regional Reliability Organization-identified events for at least three years.	Covered in the Compliance section **1.2 Evidence Retention** The following evidence retention periods identify the period of time an entity is required to retain specific evidence to demonstrate compliance. For instances where the evidence retention period specified below is shorter than the time since the last audit, the Compliance Enforcement Authority may ask an entity to provide other evidence to show that it was compliant for the full time period since the last audit. The Transmission Owner, Generator Owner, Planning Coordinator, and Reliability Coordinator shall keep data or evidence to show compliance as identified below unless directed by its Compliance Enforcement Authority to retain specific evidence for a longer period of time as part of an investigation: The Transmission Owner shall retain evidence of Requirement R1, Measure M1 for five calendar years. The Transmission Owner shall retain evidence of Requirement R6, Measure M6 for three calendar years. The Generator Owner shall retain evidence of Requirement R7, Measure M7 for three calendar years. The Transmission Owner and Generator Owner shall retain evidence of requested data provided as per~~of~~ Requirements R2, R3, R4, R8, R9, R10, R11, and R12, Measures

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
	M2, M3, M4, M8, M9, M10, M11, and M12 for three calendar years. The Responsible Entity (Planning Coordinator or Reliability Coordinator, as applicable) shall retain evidence of Requirement R5, Measure M5 for five calendar years. If a Transmission Owner, Generator Owner, or Responsible Entity (Planning Coordinator or Reliability Coordinator) is found non-compliant, it shall keep information related to the non-compliance until mitigation is complete and approved or for the time specified above, whichever is longer. The Compliance Enforcement Authority shall keep the last audit records and all requested and submitted subsequent audit records.
Notes: PRC-018-1, Requirement R5 is covered in the PRC-002-2 Compliance section under Evidence Retention.	
R6. Each Transmission Owner and Generator Owner that is required by its Regional Reliability Organization to have DMEs shall have a maintenance and testing program for those DMEs that includes: R6.1. Maintenance and testing	**R12.** Each Transmission Owner and Generator Owner shall, within 90 ~~-~~calendar days of the discovery of a failure of the SER~~,~~ ~~and~~ FR or DDR data either: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* • ~~, shall r~~Restore the recording capability, or • ~~develop~~Submit a Corrective Action Plan (CAP)~~, to be submitted~~ to the Regional Entity~~,~~ and implement it.

Standard PRC-018-1 (To be Retired) FERC Approved	Proposed Standard PRC-002-2
intervals and their basis. R6.2. Summary of maintenance and testing procedures.	
Notes: PRC-018-1, Requirement R6 is covered in PRC-002-2, Requirement R12. PRC-018-1, Requirement R6 deals with routine maintenance and testing of equipment. PRC-002-2, Requirement R12 deals with the long term availability of recording capability. Both Requirements are meant to ensure the availability of the recording of data. By requiring the TOs and GOs to notify their Regional Entity reinforces the importance of the available recording capability.	

Standard PRC-002-1	Proposed Standard PRC-002-2
R1. The Regional Reliability Organization shall establish the following installation requirements for **sequence of event recording**: R1.1. Location, monitoring and recording requirements, including the following: R1.1.1. Criteria for equipment location (e.g.,	**R1.** Each Transmission Owner shall: ~~identify BES buses for which sequence of events recorder (SER) and fault recorder (FR) data is required by using the methodology in PRC-002-2, Attachment 1, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require SER data and/or FR data, and reevaluate the identified buses at least once every five calendar years.~~ [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 1.1. Identify BES buses for which sequence of events recording (SER) and fault recording (FR) data is required by using the methodology in PRC-002-2, Attachment 1; 1.2. Notify other owners of BES Elements connected to those BES buses, if any, within

Standard PRC-002-1	Proposed Standard PRC-002-2
by voltage, geographic area, station size, etc.). R1.1.2. Devices to be monitored	90-calendar days of completion of Part 1.1 that those BES Elements require SER data and/or FR data; 1.3. Re-evaluate all BES buses at least once every five calendar years in accordance with Part 1.1 and notify other owners, if any, in accordance with Part 1.2, and implement the reevaluated list of BES buses as per the Implementation Plan. **R2.** Each Transmission Owner and Generator Owner shall have SER data for circuit breaker position (open/close) for each circuit breaker itthey owns connected directly to the BES buses identified per Requirement R1 and associated with the BES Elements at those BES buses identified per Requirement R1. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]
Notes: PRC-002-1, Requirement R1 is covered in PRC-002-2, Requirements R1-R2. (See PRC-018-1, Requirement R3 above for additional information.)	
R2. The Regional Reliability Organization shall establish the following installation requirements for **fault recording**: R2.1. Location , monitoring and recording requirements,	**R1.** Each Transmission Owner shall: identify BES buses for which sequence of events recorder (SER) and fault recorder (FR) data is required by using the methodology in PRC-002-2, Attachment 1, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require SER data and/or FR data, and reevaluate the identified buses at least once every five calendar years. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 1.1. Identify BES buses for which sequence of events recording (SER) and fault

Standard PRC-002-1	Proposed Standard PRC-002-2
including the following: R2.1.1. Criteria for equipment location (e.g., by voltage, geographic area, station size, etc.). R2.1.2. Elements to be monitored at each location. R2.1.3. Electrical quantities to be recorded for each monitored element shall be sufficient to determine the following: R2.1.3.1. Three phase to neutral voltages. R2.1.3.2. Three phase currents and neutral currents. R2.1.3.3. Polarizing currents and voltages, if used. R2.1.3.4. Frequency. R2.1.3.5. Megawatts and megavars.	recording (FR) data is required by using the methodology in PRC-002-2, Attachment 1; 1.2. Notify other owners of BES Elements connected to those BES buses, if any, within 90-calendar days of completion of Part 1.1 that those BES Elements require SER data and/or FR data; 1.3. Re-evaluate all BES buses at least once every five calendar years in accordance with Part 1.1 and notify other owners, if any, in accordance with Part 1.2, and implement the reevaluated list of BES buses as per the Implementation Plan. **R3.** Each Transmission Owner and Generator Owner shall have FR data to determine the following electrical quantities for each triggered FR for~~at~~ the BES Elements they own connected to the BES buses identified per Requirement R1: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 3.1 Phase-to-neutral voltage~~s~~ for each phase of each specified line or BES bus. 3.2 Each phase current and the residual or neutral current for the following BES Elements: 3.2.1. Transformers that have a low-side operating voltage of 100kV or above. 3.2.2. Transmission ~~l~~Lines. R4. Each Transmission Owner and Generator Owner shall have FR data as specified in

Standard PRC-002-1	Proposed Standard PRC-002-2
R2.2. Technical requirements, including the following: R2.2.1.Recording duration requirements. R2.2.2. Minimum sampling rate of 16 samples per cycle. R2.2.3. Event triggering requirements.	Requirement R3 that meets the following: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **4.1** A single record or multiple records that include: • A pre-trigger record length of at least two cycles and a total~~post-trigger~~ record length of at least 30 cycles for the same trigger point. • At least two cycles of the pre-trigger data, the first three cycles of the fault, and the final cycle of the fault as seen by the fault recorder. **4.2.** A minimum recording rate of 16 samples per cycle. **4.3.** Trigger settings for at least the following: **4.3.1.** Neutral (residual) overcurrent. **4.3.2.** Phase undervoltage or overcurrent.
Notes: PRC-002-1, Requirement R2 is covered in PRC-002-2, Requirements R1, R2, R4, and R5.	
R3. The Regional Reliability Organization shall establish the following installation requirements for **dynamic Disturbance recording**: R3.1. Location , monitoring and recording requirements including the following: R3.1.1.Criteria for	R5. Each Responsible Entity shall: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **5.1** Identify BES Elements for which dynamic Disturbance recording (DDR) data is required, including the following: **5.1.1** Generating resource(s) with: **5.1.1.1** Gross individual nameplate rating greater than or equal to 500 MVA. **5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000 MVA.

Standard PRC-002-1	Proposed Standard PRC-002-2
equipment location giving consideration to the following: -Site(s) in or near major load centers -Site(s) in or near major generation clusters -Site(s) in or near major voltage sensitive areas -Site(s) on both sides of major transmission interfaces -A major transmission junction - Elements associated with Interconnection Reliability Operating Limits -Major EHV interconnections between control areas - Coordination with neighboring regions within the interconnection R3.1.2. Elements and number of phases to be monitored at each location. R3.1.3. Electrical quantities to be recorded for each monitored	**5.1.2** Any one BES Element that is part of a stability (angular or voltage) related System Operating Limit (SOL). **5.1.3** Each terminal of a high voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA, on the alternating current (AC) portion of the converter. **5.1.4** One or more BES Elements that are part of an Interconnection Reliability Operating Limits (IROL). **5.1.5** Any one BES Element within a major voltage sensitive area as defined by an area with an in-service undervoltage load shedding (UVLS) program. **5.2** Ensure a minimum DDR coverage, inclusive of those BES Elements identified in Part 5.1, of at least: **5.2.1** One BES Element **5.2.2** One BES Element per 3,000 MW of the Responsible Entity's historical simultaneous peak System Demand. **5.3** Notify all owners of identified BES Elements, within 90-calendar days of completion of Part 5.1, that their respective BES Elements require DDR data when requested. **5.4** Reevaluate all BES Elements at least once every five calendar years in accordance with Parts 5.1 and 5.2 and notify owners in accordance with Part 5.3, and implement the reevaluated list of BES Elements as per the Implementation Plan. ~~**R5.** Each Responsible Entity (Planning Coordinator or Reliability Coordinator, as applicable) shall identify BES Elements for which dynamic disturbance recorder (DDR) data is required, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses~~

Standard PRC-002-1	Proposed Standard PRC-002-2
element shall be sufficient to determine the following: R3.1.3.1. Voltage, current and frequency. R3.1.3.2. Megawatts and megavars. R3.2. Technical requirements, including the following: R3.2.1. Capability for continuous recording for devices installed after January 1, 2009. R3.2.2. Each device shall sample data at a rate of at least 960 samples per second and shall record the RMS value of electrical quantities at a rate of at least 6 records per second.	~~that those Elements may require DDR data, and reevaluate the identified buses at least once every five calendar years. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ ~~**5.1.** The BES Elements shall include the following:~~ ~~**5.1.1.** Generating resource(s) with:~~ ~~**5.1.1.1.** Gross individual nameplate rating greater than or equal to 500 MVA.~~ ~~**5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000MVA.~~ ~~**5.1.2.** Any one BES Element associated with major transmission interfaces, as defined by the Responsible Entity. Selection of major transmission interfaces should consider the following guidelines:~~ ~~• Stability related interfaces or other significant Flowgates in the NERC Book of Flowgates for the Eastern Interconnection or~~ ~~• Transfer Paths in the Western Interconnection Path Rating Catalog or~~ ~~• Voltage stability limited transfer paths or load serving area or~~ ~~• Interfaces between Balancing Authority Areas or~~ ~~• Areas of significant congestion, thermal violation history, or relatively low Available Transfer Capability (ATC)~~ ~~**5.1.3.** Each terminal of a high-voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA on the alternating current (AC) portion of the converter.~~ ~~**5.1.4.** One or more BES Elements associated with Interconnection Reliability~~

Standard PRC-002-1	Proposed Standard PRC-002-2
	~~Operating Limits.~~ ~~5.1.5. Any one BES Element within a major voltage sensitive area with an in-service undervoltage load shedding (UVLS) program.~~ ~~5.2. The BES Elements shall include a minimum of:~~ ~~5.2.1 One BES Element~~ ~~5.2.2 One additional BES Element per each additional 3,000 MW of its historical peak system Demand.~~ **R6.** Each Transmission Owner shall have DDR data to determine the following electrical quantities for each BES Element it owns for which it received notifications as identified in Requirement R5, to determine the following electrical quantities: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* 6.1 One phase-to-neutral or positive sequence voltage. 6.2 The phase current for the same phase at the same voltage corresponding to the voltage in Requirement R6, Part 6.1, or the positive sequence current. 6.3 Real Power and Reactive Power flows expressed on a three-phase basis corresponding to all circuits where current measurements are required. 6.4 Frequency of any one of the voltage(s) in Requirement R6, Part 6.1. **R8.** Each Transmission Owner and Generator Owner that is responsible for DDR data for the BES Elements identified as per Requirement R5 shall have continuous data recording and

Standard PRC-002-1	Proposed Standard PRC-002-2
	storage. If the equipment was installed prior to the effective date of this standard and is not capable of continuous recording, triggered records must meet the following: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* 8.1. Triggered record lengths of at least three minutes. **8.2.** At least one of the following three triggers: • Off nominal frequency trigger set at: Low / High o Eastern Interconnection <59.75 Hz / >61.0 Hz o Western Interconnection <59.55 Hz / >61.0 Hz o ERCOT Interconnection <59.35 Hz / >61.0 Hz o Hydro-Quebec Interconnection <58.55 Hz / >61.5 Hz • Rate of change of frequency trigger set at: o Eastern Interconnection < -0.03125 Hz/sec / > 0.125 Hz/sec o Western Interconnection < -0.05625 Hz/sec / > 0.125 Hz/sec o ERCOT Interconnection < -0.08125 Hz/sec / > 0.125 Hz/sec o Hydro-Quebec Interconnection < -0.18125 Hz/sec / > 0.1875 Hz/sec • Undervoltage trigger set no lower than 85% of normal operating voltage for a duration of 5 seconds R9. Each Transmission Owner and Generator Owner responsible for DDR data for the BES

Standard PRC-002-1	Proposed Standard PRC-002-2
	Elements identified in Requirement R5 shall have DDR data that meets the following technical specifications: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* ~~R9. Each Transmission Owner and Generator Owner shall have DDR data, for the Elements as per Requirement R5, which conform to the following technical specifications: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ 9.1 Input sampling rate of at least 960 samples per second. 9.2 Output recording rate of electrical quantities of at least 30 times per second.
Notes: PRC-002-1, Requirement R3 is covered in PRC-002-2, Requirements R5-R6 and R8-R9.	
R4. The Regional Reliability Organization shall establish requirements for facility owners to **report Disturbance data recorded** by their DME installations. The Disturbance data reporting requirements shall include the following: 4.1. Criteria for events that require the collection of data from DMEs. 4.2. List of entities that must be provided with recorded	**R11.** Each Transmission Owner and Generator Owner shall provide SER, FR, and DDR data for the BES bus locations identified per Requirement R1 and BES Elements identified per Requirement R5 to the Reliability Coordinator, Regional Entity, or NERC: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **11.1.** The recorded data will be provided within 30 calendar days of a request. **11.2.** The recorded data will be retrievable for the period of 10 calendar days preceding a request. **11.3.** SER data will be provided in ASCII Comma Separated Value (.CSV) format following Attachment 2. **11.4.** FR and DDR data will be provided in electronic files that are formatted in conformance with C37.111, IEEE Standard for Common Format for Transient Data Exchange (COMTRADE), revision C37.111.1999 or later. **11.5.** Data files will be named in conformance with C37.232, IEEE Standard for Common

Standard PRC-002-1	Proposed Standard PRC-002-2
Disturbance data. 4.3. Timetable for response to data request. 4.4. Provision for reporting Disturbance data in a format which is capable of being viewed, read and analyzed with a generic COMTRADE analysis tool, 4.5. Naming of data files in conformance with the IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files. 4.6. Data content requirements and guidelines.	Format for Naming Time Sequence Data Files (COMNAME), revision C37.232-2011 or later. ~~**R11.** Each Transmission Owner and Generator Owner shall provide SER, FR, and DDR data for the BES bus locations identified per Requirement R1 and BES Elements identified per Requirement R5 to the Reliability Coordinator, Regional Entity, or NERC: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ ~~**11.1.** The recorded data will be provided within 30 calendar days of a request.~~ ~~**11.2.** The recorded data will be retrievable for the period of 10 calendar days preceding a request.~~ ~~**11.3.** SER data will be provided in Comma Separated Value (.CSV) format following Attachment 2.~~ ~~**11.4.** FR and DDR data will be provided in electronic C37.111, (C37.111-2013 or later) IEEE Standard for Common Format for Transient Data Exchange (COMTRADE), formatted files.~~ ~~**11.5.** Data files will be named in conformance with C37.232, IEEE Standard for Common Format for Naming Time Sequence Data Files (COMNAME).~~
Notes: PRC-002-1, Requirement R4 is covered in PRC-002-2, Requirement R13.	
R5. The Regional Reliability Organization shall provide its requirements (and any revisions	~~Each Transmission Owner shall identify BES buses for which sequence of events recorder (SER) and fault recorder (FR) data is required by using the methodology in PRC-002-2, Attachment 1, notify within 90 calendar days other owners, if any, of Elements connected~~

Standard PRC-002-1	Proposed Standard PRC-002-2
to those requirements) including those for DME installation and Disturbance data reporting to the affected Transmission Owners and Generator Owners within 30 calendar days of approval of those requirements.	~~to those BES buses that those Elements may require SER data and/or FR data, and reevaluate the identified buses at least once every five calendar years. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]~~ **R1.** Each Transmission Owner shall: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 1.1. Identify BES buses for which sequence of events recording (SER) and fault recording (FR) data is required by using the methodology in PRC-002-2, Attachment 1; 1.2. Notify other owners of BES Elements connected to those BES buses, if any, within 90-calendar days of completion of Part 1.1 that those BES Elements require SER data and/or FR data; 1.3. Re-evaluate all BES buses at least once every five calendar years in accordance with Part 1.1 and notify other owners, if any, in accordance with Part 1.2, and implement the reevaluated list of BES buses as per the Implementation Plan. R5. Each Responsible Entity shall: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **5.1** Identify BES Elements for which dynamic Disturbance recording (DDR) data is required, including the following: **5.1.1** Generating resource(s) with: **5.1.1.1** Gross individual nameplate rating greater than or equal to 500 MVA.

Standard PRC-002-1	Proposed Standard PRC-002-2
	5.1.1.2 Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000 MVA. **5.1.2** Any one BES Element that is part of a stability (angular or voltage) related System Operating Limit (SOL). **5.1.3** Each terminal of a high voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA, on the alternating current (AC) portion of the converter. **5.1.4** One or more BES Elements that are part of an Interconnection Reliability Operating Limits (IROL). **5.1.5** Any one BES Element within a major voltage sensitive area as defined by an area with an in-service undervoltage load shedding (UVLS) program. **5.2** Ensure a minimum DDR coverage, inclusive of those BES Elements identified in Part 5.1, of at least: **5.2.1** One BES Element **5.2.2** One BES Element per 3,000 MW of the Responsible Entity's historical simultaneous peak System Demand. **5.3** Notify all owners of identified BES Elements, within 90-calendar days of completion of Part 5.1, that their respective BES Elements require DDR data when requested. **5.4** Reevaluate all BES Elements at least once every five calendar years in accordance with Parts 5.1 and 5.2 and notify owners in accordance with Part 5.3, and implement the reevaluated list of BES Elements as per the Implementation Plan.

Standard PRC-002-1	Proposed Standard PRC-002-2
	R5. Each Responsible Entity (Planning Coordinator or Reliability Coordinator, as applicable) shall identify BES Elements for which dynamic disturbance recorder (DDR) data is required, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require DDR data, and reevaluate the identified buses at least once every five calendar years. *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **5.1.** The BES Elements shall include the following: **5.1.1.** Generating resource(s) with: **5.1.1.1.** Gross individual nameplate rating greater than or equal to 500 MVA. **5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000MVA. **5.1.2.** Any one BES Element associated with major transmission interfaces, as defined by the Responsible Entity. Selection of major transmission interfaces should consider the following guidelines: Stability related interfaces or other significant Flowgates in the NERC Book of Flowgates for the Eastern Interconnection or Transfer Paths in the Western Interconnection Path Rating Catalog or Voltage stability limited transfer paths or load serving area or Interfaces between Balancing Authority Areas or Areas of significant congestion, thermal violation history, or relatively low Available

Standard PRC-002-1	Proposed Standard PRC-002-2
	~~Transfer Capability (ATC)~~ ~~**5.1.3.** Each terminal of a high-voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA on the alternating current (AC) portion of the converter.~~ ~~**5.1.4.** One or more BES Elements associated with Interconnection Reliability Operating Limits.~~ ~~**5.1.5.** Any one BES Element within a major voltage sensitive area with an in-service undervoltage load shedding (UVLS) program.~~ ~~**5.2.** The BES Elements shall include a minimum of:~~ ~~**5.**2.1 One BES Element~~ ~~**5.**2.2 One additional BES Element per each additional 3,000 MW of its historical peak system Demand.~~
Notes: PRC-002-1, Requirement R5 is covered in PRC-002-2, Requirements R2, R6-R7.	
R6. The Regional Reliability Organization shall periodically (**at least every five years**) review, update and approve its Regional requirements for Disturbance monitoring and reporting.	**R1.** Each Transmission Owner shall: [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning] 1.1. Identify BES buses for which sequence of events recording (SER) and fault recording (FR) data is required by using the methodology in PRC-002-2, Attachment 1; 1.2. Notify other owners of BES Elements connected to those BES buses, if any, within

Standard PRC-002-1	Proposed Standard PRC-002-2
	90-calendar days of completion of Part 1.1 that those BES Elements require SER data and/or FR data; 1.3. Re-evaluate all BES buses at least once every five calendar years in accordance with Part 1.1 and notify other owners, if any, in accordance with Part 1.2, and implement the reevaluated list of BES buses as per the Implementation Plan. ~~**R1.** Each Transmission Owner shall identify BES buses for which sequence of events recorder (SER) and fault recorder (FR) data is required by using the methodology in PRC-002-2, Attachment 1, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require SER data and/or FR data, and reevaluate the identified buses at least once every five calendar years. [Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]~~ R5. Each Responsible Entity shall: *[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]* **5.1** Identify BES Elements for which dynamic Disturbance recording (DDR) data is required, including the following: **5.1.1** Generating resource(s) with: **5.1.1.1** Gross individual nameplate rating greater than or equal to 500 MVA. **5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater

Standard PRC-002-1	Proposed Standard PRC-002-2
	than or equal to 1000 MVA. **5.1.2** Any one BES Element that is part of a stability (angular or voltage) related System Operating Limit (SOL). **5.1.3** Each terminal of a high voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA, on the alternating current (AC) portion of the converter. **5.1.4** One or more BES Elements that are part of an Interconnection Reliability Operating Limits (IROL). **5.1.5** Any one BES Element within a major voltage sensitive area as defined by an area with an in-service undervoltage load shedding (UVLS) program. **5.2** Ensure a minimum DDR coverage, inclusive of those BES Elements identified in Part 5.1, of at least: **5.2.1** One BES Element **5.2.2** One BES Element per 3,000 MW of the Responsible Entity's historical simultaneous peak System Demand. **5.3** Notify all owners of identified BES Elements, within 90-calendar days of completion of Part 5.1, that their respective BES Elements require DDR data when requested. **5.4** Reevaluate all BES Elements at least once every five calendar years in accordance with Parts 5.1 and 5.2 and notify owners in accordance with Part 5.3, and implement the reevaluated list of BES Elements as per the Implementation Plan. ~~**R5.** Each Responsible Entity (Planning Coordinator or Reliability Coordinator, as applicable) shall identify BES Elements for which dynamic disturbance recorder (DDR) data is~~

Standard PRC-002-1	Proposed Standard PRC-002-2
	~~required, notify within 90 calendar days other owners, if any, of Elements connected to those BES buses that those Elements may require DDR data, and reevaluate the identified buses at least once every five calendar years.~~ ~~*[Violation Risk Factor: Lower] [Time Horizon: Long-term Planning]*~~ ~~**5.1.** The BES Elements shall include the following:~~ ~~**5.1.1.** Generating resource(s) with:~~ ~~**5.1.1.1.** Gross individual nameplate rating greater than or equal to 500 MVA.~~ ~~**5.1.1.2** Gross individual nameplate rating greater than or equal to 300 MVA where the gross plant/facility aggregate nameplate rating is greater than or equal to 1000MVA.~~ ~~**5.1.2.** Any one BES Element associated with major transmission interfaces, as defined by the Responsible Entity. Selection of major transmission interfaces should consider the following guidelines:~~ ~~• Stability related interfaces or other significant Flowgates in the NERC Book of Flowgates for the Eastern Interconnection or~~ ~~• Transfer Paths in the Western Interconnection Path Rating Catalog or~~ ~~• Voltage stability limited transfer paths or load serving area or~~ ~~• Interfaces between Balancing Authority Areas or~~ ~~• Areas of significant congestion, thermal violation history, or relatively low Available Transfer Capability (ATC)~~ ~~**5.1.3.** Each terminal of a high-voltage direct current (HVDC) circuit with nameplate rating greater than or equal to 300 MVA on the alternating~~

Standard PRC-002-1	Proposed Standard PRC-002-2
	~~current (AC) portion of the converter.~~ ~~**5.1.4.** One or more BES Elements associated with Interconnection Reliability Operating Limits.~~ ~~**5.1.5.** Any one BES Element within a major voltage sensitive area with an in-service undervoltage load shedding (UVLS) program.~~ ~~**5.2.** The BES Elements shall include a minimum of:~~ ~~**5.**2.1 One BES Element~~ ~~**5.**2.2 One additional BES Element per each additional 3,000 MW of its historical peak system Demand.~~
Notes: PRC-002-1, Requirement R6 is covered in PRC-002-2, Requirements R1 and R5.	