



Title: Definition of FRCC Regional Disturbance Monitoring and Reporting Requirements

A. Introduction

1. **Title:** Definition of FRCC Regional Disturbance Monitoring and Reporting Requirements
2. **Number:** PRC-002-FRCC-01
3. **Purpose:** To provide FRCC requirements for installation of Disturbance Monitoring Equipment (DME) and reporting of Disturbance data to facilitate analyses of events and verify system models.
4. **Applicability:**
 - 4.1 Transmission Owner (TO) within the FRCC.
 - 4.2 Generator Owner (GO) within the FRCC.
5. **Effective Date:** TBD

B. Requirements:

R1. Sequence of Event Recording (SER) equipment :

[Risk Factor: Lower] - [Time Horizon: Long-Term Planning]

R1.1 Location Requirements:

In general, SER equipment shall be installed at the following locations

- R1.1.1** At major transmission stations with more than four (4) transmission lines above 200kV or installed at a station within two (2) transmission busses (non-tapped) away from that station (station must contain 4 or more transmission lines and under same ownership).
- R1.1.2** At Interregional transmission interconnections operating at 200kV or above, or installed within two (2) transmission busses (non-tapped) away from that location (facilities under same ownership).
- R1.1.3** At generating sites with 1200MW or greater of installed generating capacity.
- R1.1.4** At additional locations required by the FRCC and specifically identified in Appendix A of this standard.

R1.2 The specific location of SER equipment selected to satisfy the criteria contained in **R1.1.1 – R1.1.3**, will normally be the responsibility of the TO or GO with the exception of locations specified in **R1.1.4**.



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R1.3 Monitoring Requirements:

R1.3.1 Transmission circuit breaker positions ^{note1}

R1.3.2 Generator circuit breaker positions (at transmission stations regardless of voltage level)

R1.3.3 Protective relay system trip ^{note1}

R1.3.4 Relay protection communication ^{note1}

R1.3.5 Recordings shall be available for at least 10 calendar days.

note1: For equipment operating at 200 kV or greater

R1.4 Recording Requirements:

R1.4.1 SER shall time stamp received events with a resolution of 1 ms or less.

R1.4.2 SER recorded events shall have a timing error of 4ms (or less) ^{note 2}.

note 2: Sequence of event recording can be provided as part of another device, such as a Supervisory Control and Data Acquisition (SCADA) Remote Terminal Unit (RTU), a generator plant Digital (or Distributed) Control System (DCS) or part of fault recording equipment. Timing of events must be synchronized to GPS or a timing standard in order to satisfy the recording criteria standard.

R2. Fault Recording (FR) equipment – (including Digital Fault Recorders (DFR)):
[Risk Factor: Lower] - [Time Horizon: Long-Term Planning]

R2.1 Location Requirements:

In general, FR equipment shall be installed at the following locations:

R2.1.1 At major transmission stations with more than four (4) transmission lines above 200kV or installed at a station within two (2) transmission busses (non-tapped) away from that station (station must contain 4 or more transmission lines and under same ownership).

R2.1.2 At Interregional transmission interconnections operating at 200kV or above, or installed within two (2) transmission busses (non-tapped) away from that location (facilities under same ownership).

R2.1.3 At generating sites with 1200MW or greater of installed generating capacity.



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R2.1.4 At additional locations required by the FRCC and specifically identified in Appendix A of this standard.

R2.2 The determination of specific equipment locations selected to satisfy the criteria contained in **R2.1.1 – R2.1.3**, will be the responsibility of the TO or GO with the exception of locations specified in **R2.1.4**.

R2.3 Monitoring Requirements:

R2.3.1 Transmission lines operated at 200 kV or above

R2.3.2 Transformers with secondary (low voltage) windings operating at 200 kV or above.

R2.3.3 Generator or Generator Step-up (GSU) transformers connected at 200 kV or above ^{note 3}.

R2.3.4 Electrical quantities to be recorded for each monitored element shall be sufficient to determine the following:

R2.3.4.1 Three phase-to-neutral voltages ^{note 4}.

R2.3.4.2 Three phase currents and neutral currents.

R2.3.4.3 Polarizing currents and voltages, if used.

R2.3.4.4 Frequency.

R2.3.4.5 Megawatts (MW) and megavars (MVARs).

R2.3.5 Recordings shall be available for at least 10 calendar days.

note 3: Where qualifying sites include multiple units that have outputs connected to a common collector bus, FR equipment may be installed on the common bus.

note 4: Generator voltages may be monitored phase-to-ground or phase-to-phase.

R2.4 Technical requirements:

R2.4.1 Recording duration shall be at least 30 cycles in total length with a minimum



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of 3 cycles of pre-fault data.

- R2.4.2** Minimum sampling rate of 16 samples per cycle.
- R2.4.3** Triggering is to be automatic based on relay operation or abnormal voltage and current conditions.
- R.2.4.4** Time synchronization shall be in accordance with NERC Reliability Standard PRC-018.

R3. Dynamic Disturbance Recording (DDR) equipment :

[Risk Factor: Lower] - [Time Horizon: Long-Term Planning]

R3.1 Location and Element Requirements:

Based on the peninsular geography of the FRCC along with selected locations related to FRCC Special Protection Systems. DDR equipment shall be available on the specific locations and elements identified in Appendix B.

R3.2 Monitoring Requirements:

DDR equipment shall record at least one phase of voltage and current for the elements specified in requirement R3.1. Voltage and/or current recordings shall be from the same phase(s).

R3.3 Recording Requirements:

Electrical quantities to be recorded shall be sufficient to determine the following:

- R3.3.1** Voltage (either directly or readily derivable)
- R3.3.2** Current
- R3.3.3** Frequency (at least one per DDR location)
- R3.3.4** MW and MVAR flows expressed on a three-phase basis (per each monitored line)
- R3.3.5** Recordings shall be available for at least 10 calendar days.

R3.4 Technical Requirements (equipment):

R3.4.1 Any DDR equipment installed after (date TBD) at locations specified in Appendix B shall provide for continuous recording ^{note 5} with a minimum historical retention period of 10 calendar days.



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R3.4.2 Existing DDRs which do not have continuous recording capability shall be triggered according to the following:

R3.4.2.1 DDRs shall be capable of rate-of-change of frequency and rate-of-change of voltage triggers.

R3.4.2.2 Oscillation triggers, if available, should be set to trigger for low frequency oscillations in 0.2 to 3.0 Hz range.

R3.4.2.3 DDRs shall be capable of recording minimum record lengths of not less than three minutes.

R3.4.3 Each device shall sample data at a rate of at least 960 samples per second.

R3.4.4 Each device shall record the RMS value of electrical quantities at a rate of at least 6 records per second.

R.3.4.5 Time synchronization shall be in accordance with NERC Reliability Standard PRC-018.

note 5: Capability for continuous recording for devices installed after January 1, 2009.

R4 Disturbance Criteria for Reporting:

[Risk Factor: Lower] - [Time Horizon: Long-Term Planning]

R4.1 Criteria for events that require the collection of data from DME installations.

Power system disturbances are to be captured by substation monitoring equipment and records made available upon request to the FRCC. For the purpose of this document a disturbance is defined as one of the following conditions:

1. The loss of bulk power transmission that significantly affects the integrity of the interconnected system operation.
2. Loss of generation by a utility or generation supply entity in excess of 2,000 MW.
3. The correct operation of underfrequency load shedding or undervoltage load shedding, that results in loss of load of more than 200 MW.
4. Complete operational failure or shut-down of the bulk-power transmission system
5. Electrical System Separation (Islanding) where part or parts of a power grid remain(s) operational in an otherwise blacked out area or within the partial failure of an integrated electrical system
6. Uncontrolled loss of 300 Megawatts or more of firm system loads for more than 15 minutes from a single incident.



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R4.2 The owners shall collect all relevant DME recordings as requested by the FRCC.

R4.3 The owners shall provide relevant DME recordings ^{note 6} to the FRCC within 20 calendar days of a request by the FRCC.

note 6: Where significant, records shall be annotated to indicate known equipment time delays or time synchronization issues.

R4.4 The TO or GO shall retain copies of the relevant DME recordings that were provided to the FRCC for at least three years from the date of the disturbance.

R4.5 The data recorded by DME may be recorded in any format, including the device manufacturer's proprietary format. However, the TO or GO shall, upon request, furnish the data to FRCC in a format such that any software system capable of viewing and analyzing COMTRADE (IEEE Std. C37.111-1999 or successor) files may be used to process and evaluate the data ^{note 7}.

This requirement is applicable to equipment installed after January 1st, 2005.

note 7: Where agreed upon by the FRCC, data may be provided in other formats such as proprietary or COMTRADE electronic files, for transferring data recordings. The specific format for supplying data is left to the discretion of the TO or GO and requestor with consideration of the information needed to interpret the recordings. This information may include the items listed below.

- One line diagram/sketch of the substation where the recordings were made
- Diagram of portions of the interconnected system
- Annotation of printed graphs and text
- Description of the disturbance in sufficient detail for interpretation

Where required, further analysis assistance will be provided by the contributing TO or GO to complete the FRCC analysis of a disturbance.

R4.6. Data files reported to FRCC shall be named ^{note 8} in conformance with the IEEE C37.232 *Recommended Practice for Naming Time Sequence Data Files*.

note 8: Compliance with this requirement is not effective until the IEEE standard is approved.



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R5 Standard Review Cycle:

[Risk Factor: Lower] - [Time Horizon: Long-Term Planning]

R5.1 The FRCC shall periodically review, update and approve this standard as required

R5.2 Minimum review cycle is five (5) years.

C. Measures:

Note the “Measures” of this Regional Reliability Standard are intended to correlate and supplement the “Measures” of NERC Reliability Standard, PRC-018-1, *Disturbance Monitoring Equipment Installation and Data Reporting*.

M1. The Transmission Owner and Generator Owner shall each have evidence that equipment capable of SER recording is installed at locations satisfying the location criteria and equipment requirements of requirement R1 of this standard.

M2. The Transmission Owner and Generator Owner shall each have evidence that equipment capable of Fault recording is installed at locations satisfying the location criteria and equipment requirements of requirement R2 of this standard.

M3. The Transmission Owner shall have evidence that equipment capable of dynamic disturbance recording is installed at locations satisfying the location / element criteria and equipment requirements of requirement R3 of this standard.

M4. The Transmission Owner and Generator Owner shall each have evidence that they provided and retained, requested disturbance data in accordance with the reporting requirements of requirement R4 of this standard.

M5. The FRCC shall have evidence that this standard has been reviewed and updated as necessary within the last (5) years.

D. Compliance:

1. Compliance Monitoring Process

1.1 Compliance Monitoring Responsibility:
Compliance Monitor: FRCC Regional Entity



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1.2 Compliance Monitoring Period and Reset Timeframe:

One calendar year

1.3 Data Retention:

The Transmission Owner and Generator Owner shall each retain any Disturbance data provided to the Regional Reliability Organization (Requirement 4) for three years.

The Compliance Monitor shall retain any audit data for three years.

1.4 Additional Compliance Information

The Transmission Owner and Generator Owner shall demonstrate compliance through self-certification or audit (periodic, as part of targeted monitoring or initiated by complaint or event), as determined by the Compliance Monitor.

1.5 Compliance Mitigation Factors

The following shall be considered when determining the Violation Severity Levels (VSLs) of non-compliances to this standard:

Where post-disturbance data is unavailable from a specified DME device, disturbance data may be provided from alternate DME or other devices such as digital protective relays, phasor measurement units (PMUs) and power quality recorders.

2. Violation Severity Levels (VSLs)

2.1. Lower: There shall be a Lower VSL non-compliance if any of the following conditions is present:

2.1.1 DMEs that meet all the requirements (in accordance with Requirement R1, R2 and R3) were installed at 90% or more but not all of the required locations.

2.1.2 Recorded Disturbance data that meets all the Disturbance data requirements of requirement R4 was provided for 90% or more but not all of the required locations.

2.2. Moderate: There shall be a Moderate VSL non-compliance if any of the following conditions is present:

2.2.1 DMEs that meet all the requirements (in accordance with R1, R2 and R3) were installed at 80% or more but less than 90% of the required locations.



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- 2.2.2** Recorded Disturbance data that meets all the Disturbance data requirements of requirement R4 was provided for 80% or more but less than 90% of the required locations.
 - 2.3. High:** There shall be a High VSL non-compliance if any of the following conditions is present:

 - 2.3.1** DMEs that meet all the requirements (in accordance with R1, R2 and R3) were installed at 70% or more but less than 80% of the required locations.
 - 2.3.2** Recorded Disturbance data that meets all the Disturbance data requirements of requirement R4 was provided for 70% or more but less than 80% of the required locations.
 - 2.4. Severe:** There shall be a Severe VSL non-compliance if any one of the following conditions is present:

 - 2.4.1** DMEs that meet all the requirements (in accordance with R1, R2 and R3) were installed at less than 70% of the required locations.
 - 2.4.2** Recorded Disturbance data that meets all the Disturbance data requirements of requirement R4 was provided for less than 70% of the required locations.



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Appendix A

Additional locations specifically required as specified in requirements R1.1.4 and R2.1.4 of this standard.

<u>Substation</u>	<u>Owner</u>	<u>Element (Lines)</u>	<u>Basis:</u>
Ft. White	PEF	All 230 kV lines	monitor
Debary	PEF	All 230 kV lines	monitor
Lake Bryan	PEF	All 230 kV lines	monitor
West	LAK	All 230 kV lines	monitor

Table 1:

Table lists the specific locations that require the availability of Sequence of Event Recording (SER) and Fault Recording (FR) equipment capabilities, in addition to those locations meeting the criteria specified in requirements **R1.1** and **R2.1** of this standard.

Legend:

Monitor - Lack of locations within proximity, meeting required SER and FR criteria and therefore, potential lack of monitoring capability across a substantial electrical area.



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Appendix B

Based on the peninsular geography of the FRCC along with selected locations related to FRCC Special Protection Systems, DDR shall be available at the specific locations identified in Table 2 below.

<u>Substation</u>	<u>Owner</u>	<u>Element (Lines)</u>	<u>Basis:</u>
Duval	FPL	Duval / Hatch 500 kV	SPS
		Duval / Thalmann 500 kV	SPS
		Duval / Kingsland 230 kV	SPS
Ft. White	PEF	Ft White / Suwannee 230 kV	SPS
		Ft White / Archer 230 kV	SPS
		Ft White / Newberry 230 kV	SPS
Seminole	SEC	Seminole / Black Creek 230 kV	SPS
		Seminole / Silver Springs No. #1 230 kV	SPS
Putnam	FPL	Putnam / Volusia 230 kV	SPS
Malabar	FPL	Malabar / Midway 230 kV	SPS
Orange River	FPL	Orange River / Andytown 500 kV	SPS
		Orange River / Alva 230 kV	SPS
Hopkins	TAL	Hopkins / Sub 20 230 kV	metro
Center Park	JEA	Center Park / Northside 230 kV	metro
		Center Park / SJRPP 230 kV	metro
		Center Park / Greenland	metro
		Center Park / Robinwood	metro
Lake Tarpon	PEF	Lake Tarpon / Brookridge 500 kV	SPS
Lake Tarpon	PEF	Lake Tarpon / Sheldon Rd #1 230 kV	metro
		Lake Tarpon / Seven Springs 230 kV	metro
		Lake Tarpon / East Clearwater 230 kV	metro
Big Bend	TEC	Big Bend / Manatee 230 kV	metro
		Big Bend / S. Gibsonton 230 kV	metro
		Big Bend / Mines 230 kV	metro
Gannon	TEC	Gannon / Juneau 230 kV	metro
		Gannon / Fishhawk 230 kV	metro
Stanton	OUC	Stanton / Curry Ford 230 kV	metro
		Stanton / Taft 230 kV	metro
Suwannee	PEF	Suwannee / Pinegrove 230 kV	coverage
		Suwannee / Perry 230 kV	coverage
		Suwannee / Ft White 230 kV	coverage
Charlotte	FPL	Charlotte / Whidden #1 230 kV	coverage
		Charlotte / Ringling 230 kV	coverage



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		Charlotte / Ft Myers #1 230 kV	coverage
Pebbledale	TEC	Pebbledale / Polk #1 230 kV	coverage
		Pebbledale / Barcola 230 kV	coverage
		Pebbledale / N. Bartow 230 kV	coverage
Turkey Point	FPL	Turkey Point / Flagami #1 230 kV	coverage
Windermere	PEF	Windermere / Southwood 230 kV	coverage
		Windermere / Camp Lake 230 kV	coverage
		Windermere / International Dr. 230 kV	coverage

Table 2:

Table lists the specific locations that require the availability of Dynamic Disturbance Recording (DDR) equipment capability.

Legend:

- SPS - Station visibility required to monitor Special Protection Systems actuation
- Metro - Site(s) in or near major load centers
- Coverage - Station visibility required due to unmonitored concentration of transmission elements

Note: These locations have been determined to provide adequate recording visibility within the FRCC and address the following criteria as they pertain to the FRCC transmission system topology and generation patterns.

- 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