

**Definitions of Terms Used in Standard**

*This section includes all newly defined or revised terms used in the proposed standard. Terms already defined in the Reliability Standards Glossary of Terms are not repeated here. New or revised definitions listed below become approved when the proposed standard is approved. When the standard becomes effective, these defined terms will be removed from the individual standard and added to the Glossary.*

**Disturbance Monitoring Equipment (DME):** Devices capable of [monitoring and](#) recording system data pertaining to a Disturbance. Such ~~equipment~~ [devices](#) includes the following categories of recorders<sup>1</sup>:

- Sequence of event recorders, which record equipment response to the event
- Fault recorders, which record actual waveform data replicating the system primary voltages and currents. This may include protective relays.
- Dynamic Disturbance Recorders (DDR), which record incidents that portray power system behavior during dynamic events such as low-frequency (0.1 Hz – 3 Hz) oscillations and abnormal frequency or voltage excursions

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<sup>1</sup> [Phasor Measurement Units that meet the functional requirements of DMEs may qualify as DMEs.](#)

## Standard PRC-002-1 — Define Regional Disturbance Monitoring and Reporting Requirements

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### A. Introduction

1. **Title:** Define Regional Disturbance Monitoring and Reporting Requirements
2. **Number:** PRC-002-1
3. **Purpose:** Ensure that Regional Reliability Organizations establish requirements for installation of Disturbance Monitoring Equipment (DME) and reporting of Disturbance data to facilitate analyses of events.
4. **Applicability**
  - 4.1. Regional Reliability Organization.
5. **Proposed Effective Date:** ~~January 1, 2007~~ Nine months after BOT adoption.

### B. Requirements

- R1. The Regional Reliability Organization shall establish the following installation requirements for sequence of event recording ~~equipment~~:
  - ~~R1.1.~~ Location, ~~and~~ 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.~~ Protection System dDevices to be monitored.
  - ~~R1.2.~~ Equipment requirements, including the following:
    - ~~R1.2.1.~~ Each device shall record events with a resolution of one millisecond or better.
    - ~~R1.2.2.~~ Each device shall be synchronized to within four milliseconds of Coordinated Universal Time (UTC). The recorded time may be expressed as local time, as long as the local time zone used is clearly stated.
- R2. The Regional Reliability Organization shall establish the following installation requirements for fault recording ~~Equipment~~:
  - ~~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.~~ Equipment Technical requirements, including the following:
    - ~~R2.2.1.~~ Recording duration requirements.
    - ~~R2.2.2.~~ Minimum sampling rate of 16 samples per cycle.

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~~R2.2.3. Each device shall be synchronized to within four milliseconds of Coordinated Universal Time (UTC). The recorded time may be expressed as local time, as long as the local time zone used is clearly stated.~~

~~R2.2.4. Event triggering requirements.~~

~~R2.2.5. Data retention capabilities (e.g., length of time data is to be available for retrieval).~~

**R3.** The Regional Reliability Organization shall establish the following installation requirements for dynamic Disturbance recording ~~(DDR) Equipment<sup>2</sup>~~:

~~R3.1.~~ Location, ~~and~~ 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 phrases to be monitored at each location.

~~R3.1.3.~~ Electrical quantities to be recorded for each monitored 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.~~ Equipment Technical requirements, including the following:

~~R3.2.1.~~ ~~For installations effective three years after Board of Trustee adoption,~~  
eCapability for continuous recording.

~~R3.2.2. Each device shall be time synchronized to UTC within four milliseconds. The recorded time may be expressed as local time, as long as the local time zone used is clearly stated.~~

~~R3.2.2.~~ Each device shall sample data at a rate of at least ~~1600~~ 960 samples per second and shall record the RMS value of electrical quantities at a rate of at least 6 records per second.

~~R4.~~ ~~The Regional Reliability Organization shall establish the following requirements for the storage and retention of the Disturbance data for specific system Disturbance events.~~

~~R4.1.~~ ~~All continuously recording DDRs installed after January 1, 2008 shall retain data for at least ten days.~~

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<sup>2 2</sup> These requirements do not address Phasor Measurement Units (PMUs).

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~~R4.2. All captured DME data for Regional Reliability Organization identified events shall be archived for at least three years.~~

**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:

~~R4.1.~~ Criteria for events that require the collection of data from DMEs.

~~R4.2.~~ List of entities that must be provided with recorded Disturbance data.

~~R4.3.~~ Timetable for response to data request.

~~R4.4.~~ Provision for reporting Availability of recorded Disturbance data in COMTRADE format (in conformance with IEEE ~~Std.~~ C37.111-1999 IEEE Standard Common Format for Transient Data Exchange (COMTRADE) for Power Systems, or its successor standard).

~~R4.5.~~ Naming of data files in conformance with the IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files ~~(C37.232)~~<sup>3</sup>.

~~R4.6.~~ Data content requirements and guidelines.

~~R6. The Regional Reliability Organization shall establish requirements for DME maintenance and testing.~~

~~R6.~~R5. \_\_\_\_\_ The Regional Reliability Organization shall provide its requirements (and any revisions to those requirements) including those for DME installation and ~~;~~ Disturbance data reporting; ~~Disturbance data storage and retention; and DME maintenance and testing~~ to the affected Transmission Owners and Generator Owners within 30 calendar days of approval of those requirements.

~~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.

### C. Measures

**M1.** The Regional Reliability Organization's requirements for the installation of Disturbance Monitoring Equipment shall address Requirements 1 through 3.

~~M2. The Regional Reliability Organization's requirements for storage and retention of Disturbance data shall include all elements identified in Requirement 4.~~

~~M3.~~M2. \_\_\_\_\_ The Regional Reliability Organization's Disturbance monitoring data reporting requirements shall include all elements identified in Requirement ~~5~~4.

~~M4. The Regional Reliability Organization shall have requirements for the maintenance and testing of DME equipment as required in Requirement 6.~~

~~M5.~~M3. \_\_\_\_\_ The Regional Reliability Organization shall have evidence it provided its Regional Disturbance monitoring and reporting requirements as required in Requirement ~~7~~5.

~~M6.~~M4. \_\_\_\_\_ The Regional Reliability Organization shall have evidence it conducted a review at least once every five years of its regional requirements for Disturbance monitoring and reporting as required in Requirement 6.

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<sup>3</sup> Compliance with this requirement is not effective until the IEEE Standard is approved.

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### D. Compliance

#### 1. Compliance Monitoring Process

##### 1.1. Compliance Monitoring Responsibility

NERC.

##### 1.2. Compliance Monitoring Period and Reset Timeframe

One calendar year.

##### 1.3. Data Retention

The Regional Reliability Organization shall retain documentation of its DME requirements and any changes to it for three years.

The Compliance Monitor will retain its audit data for three years.

##### 1.4. Additional Compliance Information

The Regional Reliability Organization shall demonstrate compliance through providing its documentation of Disturbance Monitoring and Reporting requirements or self-certification as determined by the Compliance Monitor.

#### 2.1. Levels of Non-Compliance

2.1.1.1. **Level 1:** There shall be a level one non-compliance if either of the following conditions exist:

2.1.1.1.1 Disturbance data reporting requirements were not specified as required in R5R4.1 through R5R4.56.

2.1.21.1.2 No evidence it conducted a review at least once every five years of its regional requirements for Disturbance monitoring and reporting as required in R7DME maintenance and testing requirements were not specified.

2.2.1.2. **Level 2:** There shall be a level two non-compliance if any of the following conditions exist:

2.2.1.2.1 Equipment characteristicsTechnical requirements were not specified for one or more types of DMEs.

2.2.2Time synchronization requirements were not specified for one or more of the DMEs as required in R1.2.2, R2.2.3, and R3.2.2.

2.2.31.2.2 Requirements do not provide criteria for equipment location or criteria for monitored elements or monitored quantities as required R1.1, R2.1 and R3.1.

2.3.1.3. **Level 3:** Disturbance data storage and retention requirements were not specified for one or more of the DMEs as required in R4.Not applicable.

2.4.1.4. **Level 4:** Disturbance monitoring and reporting requirements were not available or were not provided to Transmission Owners and Generator Owners.

### E. Regional Differences

None identified.

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**Version History**

Version	Date	Action	Change Tracking

**Definitions of Terms Used in Standard**

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**No new definitions are proposed for this standard.**

# Standard PRC-018-1 — Disturbance Monitoring Equipment Installation and Data Reporting

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## A. Introduction

1. **Title:** **Disturbance Monitoring Equipment Installation and Data Reporting**
2. **Number:** PRC-018-1
3. **Purpose:** Ensure that Disturbance Monitoring Equipment (DME) is installed and that Disturbance data is reported in accordance with regional requirements to facilitate analyses of events.
4. **Applicability**
  - 4.1. Transmission Owner.
  - 4.2. Generator Owner.
5. **Proposed Effective Dates:**

Requirements -1 and 2:

- 50% compliant 2 years after initial issuance of regional requirements per Reliability Standard PRC-002 Requirement 5.
- 75% compliant 3 years after initial issuance of regional requirements per Reliability Standard PRC-002 R5.
- 100% compliant 4 years after initial issuance of regional requirements per Reliability Standard PRC-002 R5.

Requirements 3 through 6:

- 100% compliant 6 months after BOT adoption for already installed DME.
- 100% compliant 6 months after installation for DMEs installed to meet Regional Reliability Organization requirements per Reliability Standard PRC-002 Requirements 1, 2 and 3.

~~-25% compliant by April 1, 2008~~

~~-50% compliant by April 1, 2009~~

~~-75% compliant by April 1, 2010~~

~~-100% compliant by April 1, 2011—~~

Requirement 2 through Requirement 5:

~~-100% compliant by October 1, 2007 for already installed DME~~

## B. Requirements

- 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. The time associated with each sample or condition recorded by a DME device shall be synchronized to within 2 milliseconds of Coordinated Universal Time (UTC) or better. The time stamp cannot be greater than one millisecond from the time the condition reached the input device, measured with the local station's clock.



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- R1.2.** Recorded data from each Disturbance shall be retrievable for ten days.
- R2.** The Transmission Owner and Generator Owner shall install DME in accordance with the Regional Reliability Organization installation requirements (Reliability Standard PRC-002 Requirements 1 through 3).
- R3.** The Transmission Owner and Generator Owner shall maintain, and report to ~~the its~~ Regional Reliability Organization on request, the following data on ~~the its installed~~ DMEs installed to meet that region's installation requirements (Reliability Standard PRC-002 Requirements 1.1, 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.
- R3.3.** Installation location.
- R3.4.** Operational status.
- R3.5.** Date last tested.
- ~~**R2.4.** Resolution of time synchronization.~~
- R3.6.** Monitored eElements, such as transmission circuit, bus section, etc.-
- R3.7.** Monitored devices, such as circuit breaker, disconnect status, alarms, etc. ~~Protection System Devices.~~
- R3.8.** Monitored electrical quantities, such as voltage, current, etc..
- ~~**R2.8.** Operational status.~~
- ~~**R2.9.** Date last tested.~~
- ~~**R3.** The Transmission Owner and Generator Owner shall each store and retain its Disturbance data (recorded by DMEs) in accordance with its Regional requirements (PRC-002 Requirement R4).~~
- R4.** The Transmission Owner and Generator Owner shall each provide Disturbance data (recorded by DMEs) in accordance with the Regional Reliability Organization's requirements (Reliability Standard PRC-002 Requirement R54).
- 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.
- R6.** Each Transmission Owner and Generator Owner that is required by its Regional Reliability Organization to have DMEs shall have a DME-maintenance and testing program for those DMEs that includes:
- R6.1.** Maintenance and testing intervals and their basis.
- R6.2.** Summary of maintenance and testing procedures.
- ~~**R5.** in accordance with the Regional requirements (Reliability Standard PRC-002 Requirement R6).~~

### C. Measures

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~~M1.~~ The Transmission Owner and Generator Owner shall each have evidence that DMEs it is required to have meet the functional requirements specified in Requirement 1 and are installed in accordance with its associated Regional Reliability Organization's requirements.

~~M1.~~The Transmission Owner and Generator Owner shall each have evidence that its DME is installed in accordance with its associated Regional Reliability Organization's requirements.

M2. The Transmission Owner and Generator Owner shall each maintain the data listed in Requirement 23.1 through 23.89 for the DMEs installed to meet its Regional Reliability Organization's DME installation requirements.

M2.1 The Transmission Owner and Generator Owner shall each ~~on all its installed DME, and shall~~ have evidence it provided this DME data to its Regional Reliability Organization within 30 calendar days of a request.

M3. The Transmission Owner and Generator Owner shall each have evidence it ~~stored and~~ retained ~~and provided its~~ recorded Disturbance data to entities in accordance with its associated Regional Reliability Organization's Disturbance data reporting requirements.

~~M3.~~The Transmission Owner and Generator Owner shall each have evidence it provided recorded Disturbance data to all entities in accordance with its associated Regional Reliability Organization's requirements.

~~M5.M4.~~ TheEach Transmission Owner and Generator Owner that is required to install DMEs to meet its Regional Reliability Organization's DME installation requirements, shall each have an associated evidence its DME maintenance and testing program is in accordance with its associated Regional Reliability Organization's requirements as defined in Requirement 6.

### D. Compliance

#### 1. Compliance Monitoring Process

##### 1.1. Compliance Monitoring Responsibility

Regional Reliability Organization.

##### 1.2. Compliance Monitoring Period and Reset Timeframe

One calendar year.

##### 1.3. Data Retention

The Transmission Owner and Generator Owner shall retain any changes to the data on DME installations and any Disturbance data provided to the Regional Reliability Organization 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.

#### 2. Levels of Non-Compliance

2.1. **Level 1:** There shall be a level one non-compliance if ~~either~~ any of the following conditions is present:

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- 2.1.1 DMEs that meets all Regional Reliability Organization's installation requirements (in accordance with Requirement 42) were installed at 7590% or more but not all of ~~the~~ required locations.
  - 2.1.2.1.1 Recorded Disturbance data that meets all Regional Reliability Organization's Disturbance data requirements (in accordance with Requirement 43) was provided for 9075% or more but not all of the required locations.
- 2.1.2 Data on required DMEs was incomplete (in accordance with R3)
- 2.1.3 Documentation of the DME maintenance and testing program provided was incomplete as required in R6, but records indicate maintenance and testing did occur within the identified intervals for the portions of the program that were documented.
- 2.2. **Level 2:** There shall be a level two non-compliance if either of the following conditions is present:
  - 2.2.1 DMEs that meets all Regional Reliability Organization's installation requirements (in accordance with R42) were installed at 850% or more but less than 7590% of the required locations.
  - 2.2.2 Recorded Disturbance data that meets all Regional Reliability Organ8zation's Disturbance data requirements (in accordance with R43) was provided for 950% or more but less than 7590% of the required locations.
  - 2.2.3 Recorded Disturbance data was not provided to all required entities (in accordance with R4)
  - 2.2.4 Archived data was not retained for three years (in accordance with Requirement 5).
  - 2.2.5 Documentation of the DME maintenance and testing program provided was complete as required in R6, but records indicate that maintenance and testing did not occur within the defined intervals.
- 2.3. **Level 3:** There shall be a level three non-compliance if ~~either~~ any of the following conditions is present:
  - 2.3.1 DMEs that meets all Regional Reliability Organization's installation requirements (in accordance with R42) were installed at 2570% or more but less than 850% of the required locations.
  - 2.3.2 Recorded Disturbance data that meets all Regional Reliability Organization's Disturbance data requirements (in accordance with R43) was provided for 2570% or more but less than 580% of the required locations.
  - 2.3.3 Documentation of the DME maintenance and testing program provided was incomplete as required in R6, and records indicate implementation of the documented portions of the maintenance and testing program did not occur within the identified intervals.
- 2.4. **Level 4:** There shall be a level four non-compliance if ~~either~~ any one of the following conditions is present:

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- 2.4.1 DMEs that meets all Regional [Reliability Organization's](#) installation requirements (in accordance with [R42](#)) were installed at less than [2570](#)% of the [required](#) locations.
- 2.4.2 Recorded Disturbance data that meets all Regional [Reliability Organization's](#) [Disturbance](#) data requirements (in accordance with [R3R4](#)) was provided for less than [2570](#)% of the [required](#) locations.
- 2.4.3 [DMEs that meet all functional requirements \(in accordance with R1\) were not installed at all required locations.](#)
- 2.4.4 [Documentation of the DME maintenance and testing program, or its implementation, was not provided.](#)

### E. Regional Differences

None identified.

### Version History

Version	Date	Action	Change Tracking