March 12, 2007

IESO Comments on NPCC A15 Document

"Disturbance Monitoring Equipment Criteria"

Introduction:

The IESO thanks the NPCC for the opportunity to provide comments on the A-15 "**Disturbance Monitoring Equipment Criteria"** document. We commend the drafting team for developing this document.

Comments:

There are a few comments that we would like to make and it would be best understood if the changes were made to the document itself instead of listing each one separately. The A-15 document, with suggested changes and comments, is attached alongside.

In parallel with this transmittal, these comments have also been posted on the NPCC Open Process Form at http://www.npcc.org/.

Thank you for your attention to these concerns.

Yours truly,

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NPCC A-15 Document with Suggested Changes

1.0 Introduction

A prompt and accurate sequence of events must be established following a **disturbance** to provide timely analysis and reporting of the **disturbance**. The importance of Disturbance Monitoring Equipment (DME) in monitoring performance of **protection** equipment and validation of system simulation models has long been recognized in NPCC criteria. This document provides the application and functional requirements for NPCC DME, in accordance with NERC Reliability Standards PRC-002 and PRC-018.

2.0 General

The term Disturbance Monitoring Equipment (DME) is defined in the NERC Glossary, listed as Reference 1, and is repeated below for convenience:

"Disturbance Monitoring Equipment (DME) - Devices capable of monitoring and recording system data pertaining to a Disturbance. Such devices include the following categories of recorders:

- Sequence of event (SOE) 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 (DDRs), 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."

Footnote: Phasor Measurement Units (PMUs) and any other equipment that meets the functional requirements of DMEs may qualify as DMEs."

In this document, the terms DME, Sequence of Events Recorders, Fault Recorders, and DDRs all refer to functional capability and not to discrete devices.

All of the following applies to all new installations, and modifications to existing installations. Existing DMEs are required to be upgraded to meet these Criteria in accordance with the schedule called for in NERC Standard PRC-018-1.

This document shall be provided to the affected Reliability Coordinators (RCs), Transmission Owners (TOs), and Generator Owners (GOs) within 30 calendar days of its approval.

The TO and GO shall each install DMEs in accordance with these criteria. DMEs shall be provided to permit analysis and reporting of system protection performance, monitoring of system protection performance, and validation of system simulation models.

3.0 Sequence of Event Recording

3.1. Sequence of Event recording is the responsibility of transmission owners and **generation** owners. This capability 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.

3.2. Sequence of Event recorders shall be provided at all **bulk power system** substations and at generating units above 50 MW **capacity**, and at generating plants above 300 MW **capacity.**

3.3. Sequence of Events recording shall monitor the following at each location:

- Transmission and Generator circuit breaker positions
- Tripping **relays**
- **Teleprotection** keying & receive

4.0 Fault Recording

4.1 **Fault** recording is the responsibility of transmission owners and **generation** owners.

4.2 **Fault** recording shall be provided by the TO to the extent necessary (comment: who specifies the "extent"?) to determine the current zero time for loss of **BPS** transmission **elements**.

4.3 **Fault** recording capability shall be provided by the GO for generating units above 300 MW **capacity**.

4.4 **Fault** recorders shall monitor the following **elements** at each location where **fault** recorders are installed:

- All **BPS** Transmission Lines
- Autotransformers or phase-shifters connected to **BPS** busses
- Shunt capacitors 345 kV and above – Comment: What is the logic behind applying a voltage level here? Shouldn't this read "Shunt Capacitors

connected to **BPS** Transmission Lines" unless studies and field observations indicate otherwise.
- Individual generator interconnections
- SVCs or StatComs (comment: Technical words need to be spelled out for consistency?)
- HVDC Terminals

4.5 Electrical quantities to be recorded for each monitored **element** shall be sufficient to determine the following:

- Three phase-to-neutral voltages. (Common bus-side voltages may be used for lines.)
- Three phase currents and neutral currents.
- Polarizing currents and voltages, if used.
- Frequency.
- MegaWatts and MegaVArs Comment: These are units of measurements and not the actual parameters – Shouldn't this be replaced with "Active and Reactive Power" – This will also make this point consistent with the previous points.

4.6 **Fault** recorder record duration shall be a minimum of one (1) second.

4.7 **Fault** recorder minimum recording rate shall be 16 samples per cycle. Comment – The sampling rate must be chosen from the list of Least Common Multiple frequencies as defined in the IEEE Standard C-37-111. This document is specified in the reference section but the reference is not specific enough as to which sections the references apply.

4.8 As a minimum, **fault** recorders shall be set to trigger for all the following functions:

- **Protective Relay** tripping for all **protection groups**
- Neutral (residual) overcurrent set at 0.2 pu rated CT secondary current
- Phase undervoltage set at 0.85 pu

4.9 Local conditions may require different settings or additional functions.

5.0 Dynamic Disturbance Recording (DDR) Capability

5.1 Where the DDR capability is deemed necessary by the Reliability Coordinator, the Reliability Coordinator shall provide guidance in setting triggers and shall monitor the performance of the DDR devices.

5.2 On an **Area** basis, there shall be at least ten (10) DDRs per 30,000 MW of peak **load**, distributed throughout the system, and installed at various types of locations, with consideration given to the following factors:

- Major **load** centers
- Major **generation** clusters
- Major voltage sensitive areas
- Major transmission interfaces
- Major transmission junctions
- **Elements** associated with Interconnection Reliability Operating Limits (IROLs)
- Major EHV interconnections between control areas.

5.3 An evaluation of the need for a DDR should be made upon each new major **BPS** installation and upon each major station where a **fault** recorder replacement project is being made. (A field for this purpose will be included in the next revision of Document C-22).

5.4 DDRs shall monitor the following **elements** at each location where dynamic recorders are installed:

- Sufficient Line Currents such that normal maintenance activities do not interfere with DDR requirements. Comment – Please define what is meant by "sufficient line currents" This is a measured quantity and there should not be any ambiguity to such statements – A definition would be the right and technical way to go.
- Bus voltages

5.5 As a minimum, DDRs should monitor one phase current per monitored **element** and two phase-to-neutral voltages of different **elements**. One of the monitored voltages shall be of the same phase as the monitored current.

5.6 Electrical quantities to be recorded for each monitored **element** shall be sufficient to determine the following:

- Voltage, current, and frequency
- ~~MegaWatts and MegaVArs~~Active and Reactive Power

5.7 DDRs installed after January 1, 2009 shall function as continuous recorders. Comment: With "continuous recording" comes the issue of data storage. There must be specifics on data storage periods.

5.8 Each device shall sample data at a rate of at least 960 samples per second (16 samples per cycle and shall store the RMS value of electrical quantities at a rate of at least 6 data points per second.)

5.9 The following DDR triggers shall be considered (comment: "considering" does not ensure triggering; need tighter requirements, e.g. changing it to say: "DDRs must be triggered for the following events :"):

- Rate of change of Frequency (comment: need to be more specific, i.e. stipulating a rate of change threshold that triggers the DDRs)
- Rate of change of Power (comment: same)

- Delta Frequency 20 mHz change (comment: over how long a period?)
- Oscillation of Frequency (comment: need to be more specific, e.g. on magnitude and duration/cycle)

5.10 Local conditions may require different settings or additional functions.

5.11 When DDR triggers are used, duration of triggered records shall be a minimum of sixty (60) seconds.

6.0 Data

6.1 Recorded **disturbance** data from DMEs shall be forwarded within 30 days of receipt of the request in each of the following cases:

- Request from NERC **Disturbance** Investigation Team
- Request from NPCC **Disturbance** Investigation Team
- Reliability Coordinator Request

6.2 Data forwarded shall be archived in its native format for a period of 3 years by the TO or GO.

6.3 **Disturbance** data files shall be provided in a format which is capable of being viewed, read, and analyzed with a generic COMTRADE analysis tool.

6.4 Disturbance Data files shall be named in conformance with IEEE C37.232 Recommended Practice for Naming Time Sequence Data Files.

6.5 **Fault** Recorder and DDR Files shall contain all monitored channels. SOE (comment: need to spell out here, or the acronym be introduced at first mention of Sequence of Event) records shall contain station, date, time resolved to milliseconds, SOE point name, status.

6.6 Recorded data from each **disturbance** shall be retrievable for 10 calendar days (comment: how does it stack up with 5.11 which stipulates that the triggered record shall be at least 60 seconds?).

This requirement does not apply to **relays** unless those **relays** are designated as DME.

6.7 The TO and GO shall each maintain and be ready to report to NPCC on request the following data on the DMEs installed to meet this standard:

- Type of DME
- Make and model of equipment
- Installation location
- Operational Status
- Date last tested

- Monitored **Elements**
- Monitored Devices
- Monitored Electrical Quantities
- Technical specifications including but not limited to: sampling rates, A/D resolution, and recording times

7.0 Time Synchronization

Internal clocks in DME devices shall be time synchronized to within 2 milliseconds or less of Coordinated Universal Time (UTC) scale. The time zone shall be clearly identified as either universal time zone or local time zone.

8.0 Maintenance And Testing

Each TO, and GO shall establish a maintenance and testing program for DME (guidance for maintenance and testing is provided in Document B-26).

Prepared by:	Task Force on System Protection
Review frequency:	3 years
References:	*1. NERC "Glossary of Terms Used in Reliability Standards," November 1, 2006, available at www.nerc.com*
	2. NERC Standard PRC-002-1, "Define Regional Disturbance Monitoring and Reporting Requirements," adopted by NERC BOT on 08/02/06 and effective on 05/-2/07, available at www.nerc.com.
	3. *NERC Standard PRC-018-1, "Disturbance Monitoring Equipment Installation and Data Reporting," adopted by NERC BOT on 08/02/06 with effective dates phased in over four year period beginning 08/02/06, available at www.nerc.com.*
	4. NPCC Glossary of Terms (Document A-07)
	5. NPCC Guide to Time Synchronization of Substation Equipment (Document B-25)
	6. NPCC Guide for Application of Disturbance Recording Equipment (Document B-26)
	7. SP-6 Report, Synchronized Event Data Reporting, Editorial Revisions –

8. IEEE C37.111-1999, "IEEE Standard Common Format for Transient Data Exchange for Power Systems."

9. IEEE C37.232, "IEEE Recommended Practice for Naming Time Sequence Data Files." This document is schedule to be submitted for publication in February 2007. Refer questions to TFSP.