Proposed Dynamic Performance Monitoring Requirement for Power Plants DRAFT

December 3, 2010

Background

Phasor Measurement Units (PMUs) are to be installed at Point of Interconnection (POI) of all large generating facilities as a part of their interconnection. The PMU data is used by the Balancing Authority and Regional Transmission Operator in a variety of operational and engineering applications, including real-time situational awareness and visualization, power plant voltage and reactive power monitoring, oscillation detection, power plant dynamic performance analysis and model validation. PMU data can also be provided to the power plant owners for their own uses.

Suggested Applicability

New generating facilities [75] MW and larger should have PMUs installed at the time of interconnection. Existing generating facilities greater than [200] MW should have PMUs installed at the POI by [December 2018]. Transmission Planner may identify special cases for additional PMU applications.

Measured Signals

PMU measures three-phase voltages and currents and then calculates time-synchronized positive sequence voltage and current phasors. The phasors can be streamed continuously to control centers at the rate of 30 to 60 frames per second. PMU installation may also include "extended DFR" capabilities to archive "point-on-wave" disturbance data.

Conventional Power Plants at POI

Figure 1 shows a conceptual diagram of a PMU installation at a conventional power plant. PMU shall measure the following analog signals:

- high side 3-phase voltage of each generator step up transformer
- 3-phase currents in each high side lead to each step up transformer

Wind Power Plants at POI

Figure 2 shows a conceptual diagram of a PMU installation at a wind power plant. PMU shall measure the following analog signals:

- high side (230-kV or 115-kV) 3-phase voltage
- low side (34.5-kV) 3-phase bus voltage
- substation transformer 3-phase current at high side (typically from relaying CT)
- substation transformer 3-phase current at low side (typically from metering CT)
- 3-phase current in leads to electronically controlled reactive power device (e.g. STATCOM) (if applicable)
- total 3-phase current in leads to mechanically switched shunt capacitors and reactors

PMU shall measure the following digital signals:

- status for each plant-level shunt capacitor and reactor
- ULTC transformer tap position (if applicable)
- status of collector feeders

Phasors

PMU shall calculate positive sequence voltage and current phasors for analog signals listed above. The PMU data must-be time synchronized to GPS accuracy and time-stamped. The PMU record may include digital inputs specified above. The PMU must be compliant with IEEE C37.118 standard. PMUs will stream the data continuously to control centers.

Point-on-wave disturbance data

In addition to providing phasor measurement data the PMU may have the capability to record "point-on-wave" disturbance data. If recorded, point-on-wave data must also be time-stamped to GPS accuracy. Point-on-wave data should be recorded at a rate of at least 32 samples per cycle (at least 1920 samples per second) for each signal. Point-of-wave data is useful in analysis of electrical disturbances and verification of fault ride-through performance. The point-on-wave data should be stored locally, either in a PMU or in a local storage device in accordance with the following:

- Data storage may be started by triggering.
- A standard set of triggering thresholds including under/over voltage, under/over frequency, and remote trigger inputs should be available
- For each event all point-on-wave data shall be stored for 5 seconds before triggering and 30 seconds after triggering
- Storage should be provided for up to 100 events

Point-on-wave data is recommended for wind- and solar PV power plants, because their response can be significantly affected by what happens during a fault.

Telecommunications

Synchro-phasors shall be continuously streamed to the respective BA control centers.

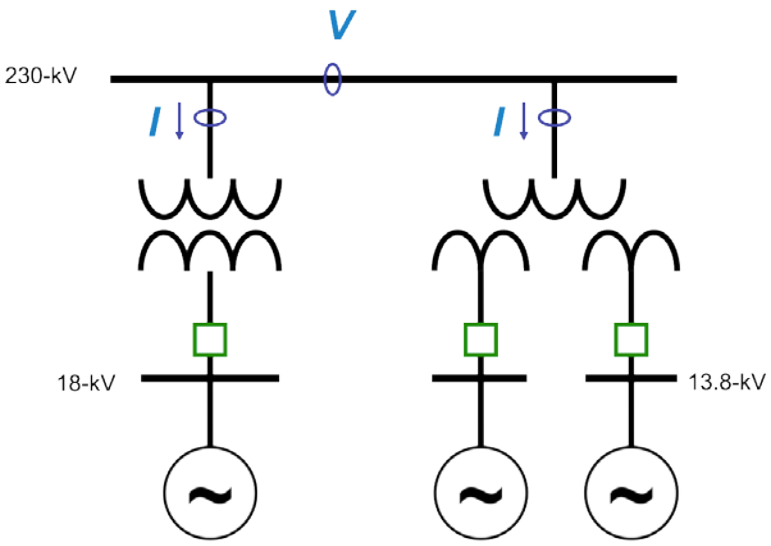

Figure 1: conceptual diagram of a disturbance monitoring installation at a conventional power plant

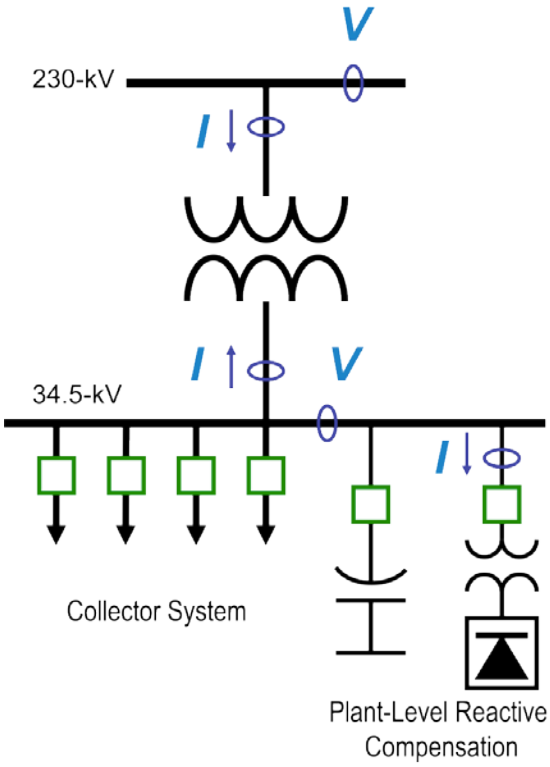

Figure 2: conceptual diagram of a disturbance monitoring installation at a wind power plant