

DYNAMIC SYSTEM MONITORING (DSM)

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PURPOSE AND SCOPE

The technical specifications for all new plant, equipment, apparatus and services, for use on the National Grid Electricity Transmission system, are contained in a three level hierarchy of documents. Level 1 covers ratings and general requirements, Level 2 covers major plant categories and Level 3 covers specific related plant functions.

This document is a level 3 Specification and details the functional and performance requirements for Dynamic System Monitoring (DSM).

Equipment topologies other than those proposed in this specification are acceptable where such solutions can be demonstrated by the supplier to meet the overall functional and performance requirement specified herein.

PART 1 – PROCEDURAL

1 FUNCTIONAL AND PERFORMANCE REQUIREMENTS

1.1 General

- 1.1.1 DSM is required to provide data on a substation and system wide basis of System Dynamic behaviour on a continuous time series basis.
- 1.1.2 Access to system data, parameter settings and the configuration of equipment shall be via a secure network connection in accordance with NATIONAL GRID IS security policies.
- 1.1.3 DSM system shall comprise:
 - a) A data acquisition unit providing both local and remote access capability.

- b) A master server at substation level and software to interrogate and collect data from all bay level data acquisition units.
 - c) All appropriate user software to access and analyse data stored on the substation master servers.
- 1.1.4 All DSM equipment shall be dual rated for use on both 110 / 48V DC supplies with characteristics as specified in TS 3.24.04.
- 1.1.5 The Data Acquisition Units shall have at least 2 x Ethernet ports and 1 x USB port

Each Ethernet port shall be capable of accepting individual TCP/IP address's and manage the data traffic independent of the other.

All cross site communications shall be conducted using fibre connections.

The USB port or a third Ethernet port shall be utilised to update the firmware locally and provide access to system configuration locally.

1.2 Time Keeping

- 1.2.1 Time keeping shall accept a GPS time source, complying with the requirements of TS 3.24.67.
- 1.2.2 Sampling of inputs and all derived data shall be time-tagged using GPS timing.
- 1.2.3 Inputs shall be sampled such that a 1 μ s timing accuracy is achieved.
- 1.2.4 Storage of data shall maintain the timing accuracy specified in 1.2.3.

1.3 Continuous Time Series Data

- 1.3.1 All data acquired by the Data Acquisition Unit shall be continuously stored.
- 1.3.2 The storage rate shall be user selectable but capable of at least 256 samples per cycle.
- 1.3.3 Non-volatile static memory shall be provided for storage of a minimum of 28 days data, prior to overwriting on a first in first out basis.
- 1.3.4 In the event of a deviation from the minimum or maximum set thresholds, the Data Acquisition Unit will trigger a flag, attach it to the event and raise a notification to the substation master server. Each user shall be able to customise their individual profile to state which system parameter flags they will be notified of. Users shall be notified of event flags immediately via user defined means (email, sms).
- 1.3.5 The following flag types shall be provided as a minimum for the parameters given in Table 1.
- a) Rate of change ($\pm$).
 - b) Level (over and/or under).
 - c) Oscillatory condition of active power values. Setting shall enable the detection of small oscillations to be made on the basis of the oscillation period, amplitude, and the number of oscillations within a given time window. The frequency of the oscillations will be in the range 0.01 to 5 Hz. Settings shall enable the detection of small oscillations to be made by configurable frequency bands.
 - d) Status inputs (change of state: open to closed, closed to open, or both).

1.4 Parameters to Measure for the Activation Flags

- 1.4.1 Parameters comprising derived values from CT and VT inputs and plant status inputs shall be determined on a real time basis as required below for the purpose of activation of flags:
- For each 3-phase voltage and current vector group: 3-phase active and reactive PPS power values.
 - For each 3-phase voltage and current vector group the PPS and NPS sequence components (rms magnitude).
 - For each vector group having single-phase voltage input: the active and reactive power values, scaled as total 3-phase power (Based on PPS current).
 - For each voltage vector group having a single-phase input: rms magnitude.
 - For each voltage vector group the system frequency, derived from one of the 3 phase VT inputs.
 - Plant status inputs

1.5 Accuracy, Resolution and Measurement Range for Time Series Data

- 1.5.1 Accuracy requirements shall be met over the power system frequency range of 45 – 55 Hz and for the range of influence quantities given in TS 3.24.15. The supplier shall provide data regarding the performance over the range 40 to 60 Hz.

Parameter	Measurement Range	Accuracy (±)% of nominal input	Resolution (±)% of nominal input	Notes
r.m.s voltage	0 – 1.5 Vn	0.1	0.01	Crest Factor ≤ 1.5
Phase sequence components (voltage)	0.8 – 1.5 Vn	0.1	0.01	Crest Factor ≤ 1.5
Phase sequence components (current)	0 – 5 In	0.1	0.02	Crest Factor ≤ 3.0
Active Power	0 – 5 Pn	0.5	0.01	Pn = nominal active power = $V_n \cdot I_n \cdot \cos \phi$. Accuracy to be maintained over the power system phase angle range unity to 60° Lag/Lead
Reactive Power	0 – 5 RPn	0.5	0.01	RPn = nominal reactive power = $V_n \cdot I_n \cdot \sin \phi$. Accuracy to be maintained over the power system phase angle range zero to 30 ° Lag/Lead
Frequency	45 – 55Hz	0.005	0.001	20 to 150% Vn.

Table 1: Accuracy, Resolution and Measurement Range.