

SIGUARD PDP

Grid Monitoring using Synchrophasors

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Description – Wide Area Monitoring Protection and Control (WAMPAC)

Decarbonization, decentralization, and the inability to expand the energy system mean ever-increasing load on equipment and therefore much greater sensitivity to dynamic processes in the power system.

SIGUARD PDP (Phasor Data Processor) monitors the dynamic processes and states in extensive power-supply systems in real time (Wide Area Monitoring). SIGUARD PDP detects and displays early when approaching critical states (frequency stability, voltage stability, transmission stability, and power swing). The critical threshold can be defined individually and modified at any time. In addition to real-time monitoring, SIGUARD PDP also offers support in the analysis of the power-supply system.

The operators of electricity-supply systems must be prepared for and react to sudden processes occurring in the power system at any time. The software monitors the electricity-supply system for critical conditions to support the network control center personnel and the protection experts in their tasks.

SIGUARD PDP uses PMUs (Phasor Measurement Units) for collecting data. These measuring devices are installed in the substations and connected to the current and voltage transformers. The PMU functionality can be retrofitted easily in existing SIPROTEC 5 devices. An IP-based communication network connects the PMUs to the SIGUARD PDP.

The PMUs deliver not only the magnitude but also the angle of the voltage and current with a high time resolution. In this way, dangerous network situations, such as an exceedance of a critical voltage-angle difference between 2 network nodes, can be detected with only a small latency and appropriate counter measures can be executed automatically. These wide area protection schemes can be implemented with the help of high-speed calculation functions in the SIGUARD PDP.



Benefits

- Fast capturing of events and trends in networks with fluctuating power flow or heavily stressed lines, which are not detected, or detected too late, by conventional systems
- Comprehensive support in the analysis of unusual events
- Checking and optimizing of protection settings using measured dynamic processes
- Secure investment with simple functional enhancement of the scalable software and continuous updates (*evergreen concept*)
- Avoiding expensive and long lasting electrical power system expansion due to a higher utilization of the existing power system after the implementation of a wide area protection scheme

Real-time data analysis

Functions

Applications for automatic and configurable real-time data analysis of the PMU data streams:

- Detection of the system decay into several isolated islands based on frequency values (*Island State Detection*)
- Real-time detection of active power swings, evaluation in terms of frequency, amplitude, damping ratio, degree of danger, and coherence of the oscillation, for multiple modes at the same time, all based on a fast Fourier analysis (*Power Swing Recognition*)
- Phase-accurate short-circuit detection based on the characteristic history of current and voltage (*Short Circuit Detection*)
- Detection of the failure of large energy-producer or consumer units based on power frequency (*Generation or Demand Loss*)
- Intuitive and adaptable user interface with patented display of the overall status as a simple trend curve
- Calculation of derived values such as voltage angle-angle difference, active power, reactive power, and apparent power, positive, negative, and zero-sequence voltages and currents, change gradients, and any more
- Limit value supervision for all measured and calculated values
- Ring-buffer archiving of all measured and calculated values as well as all application results for a configurable period of time
- Saving of unusual events in a permanent memory, either upon user request or automatically, based on configurable criteria

- Compression of archive data for fast display in the user interface over an extended period
- Communication interfaces for the export of PMU data to other IT systems
 - IEEE C37.118 to connect PDCs to a higher level or for data exchange with phasor data concentrators (PDCs) of neighboring power-system operators
 - IEC 60870-5-104 slave and/or IEC 61850 to connect SCADA/EMS/DMS systems
 - OPC DA to connect automation systems
- E-mail alerts to personnel
- Export of archive data to CSV and COMTRADE
- Provision of a programming interface (API) for customer development of applications based on PMU data

Applications

- Phasor data concentrator (PDC) for temporal synchronization of all PMUs
- Real-time data analysis of PMU data streams for critical states as integrated applications in SIGUARD PDP, to support control center personnel and protection experts
- Analysis of unusual incidents by power-system protection experts and planners
- Verification of dynamic network models
- System protection based on PMU data (Wide Area Protection)



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