



Substation Automation Systems

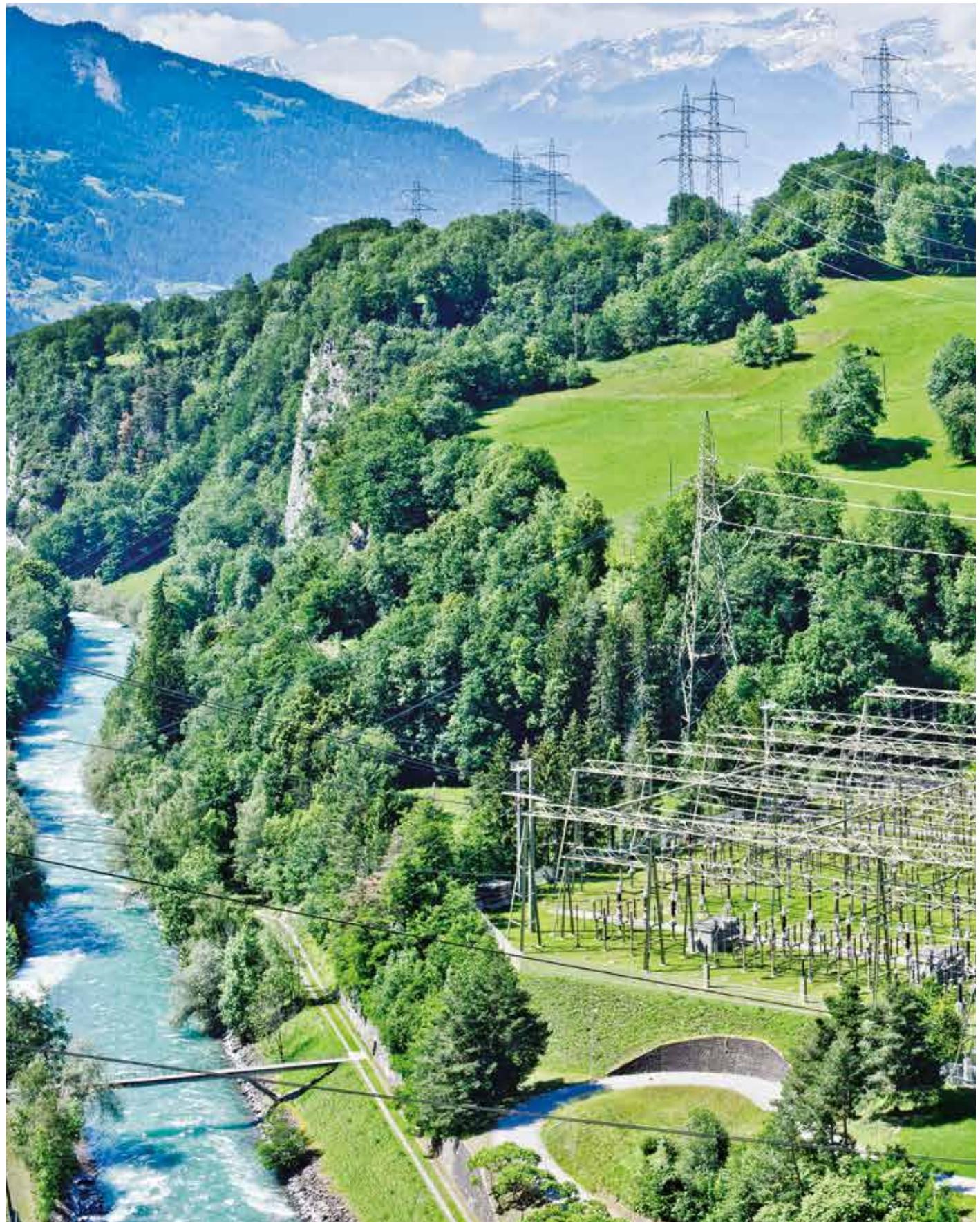
We are exceptional grid stability PSGuard Wide Area Monitoring System

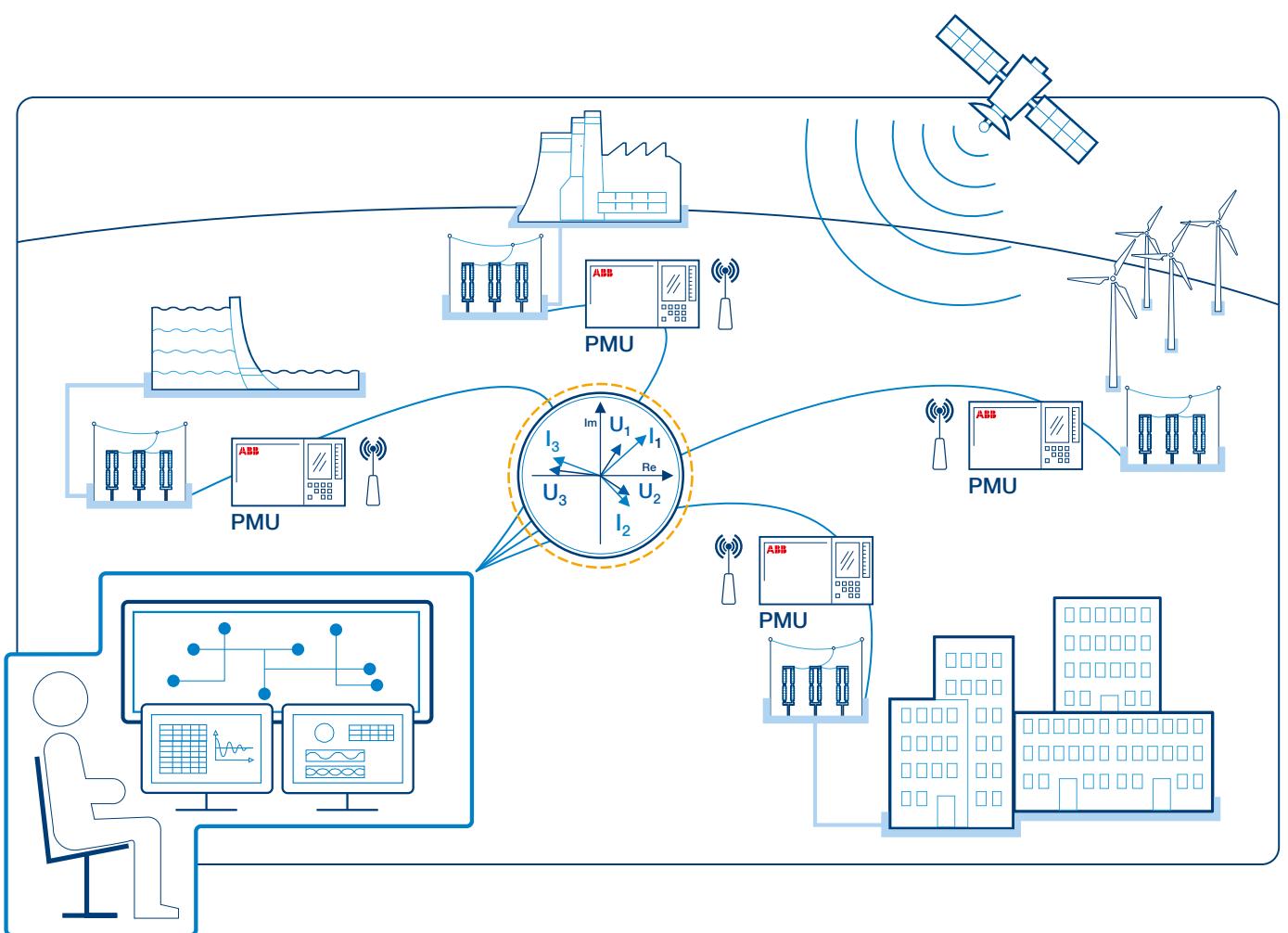
Power and productivity
for a better world™

ABB

We are exceptional grid stability

PSGuard Wide Area Monitoring System





Increasing the power flow through existing transmission systems without affecting reliability and stability has become a major challenge for power system utilities.

Many power grids are now running close to their operating limits due to the increasing electrical demand, in combination with aging electrical infrastructure, increased integration of distributed and renewable energy resources, and complex power exchanges based on electricity trading markets.

New transmission technology can significantly improve network efficiency and supply security, but increasing electrical loads also require increased visibility of power networks, to prevent overloading and detect line issues.

ABB's PSGuard Wide Area Monitoring System (WAMS) is a corner-stone technology that is designed to improve visibility and situational awareness in electrical grids, today and in the future. PSGuard collects, stores, transmits and analyzes critical data from key points across a power network, and over large geographical areas. PSGuard's state-of-the-art portfolio of Wide Area Monitoring applications is designed to detect abnormal system conditions and evaluate large area disturbances, in order to preserve system integrity and main-

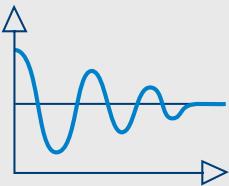
tain suitable power system performance, while offering the improved scalability and higher flexibility provided by a centralized or decentralized approach.

ABB best-in-class products and software enable a future-proof Wide Area Monitoring system, thanks to a Phasor Data Concentrator that can be installed in PC-type servers, and is fully compliant with the latest standards.

Complex and geographically enormous power networks can rely on high-performance PSGuard Wide Area Monitoring applications to detect abnormal system conditions, evaluate disturbances, and preserve the integrity, stability and performance of the network.

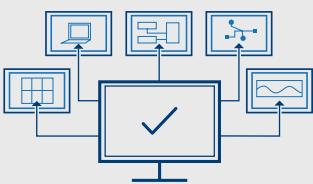
PSGuard delivers real time overviews of large systems, helping operators to quickly identify network disturbances and evaluate past events. PSGuard applications include basic monitoring and system supervision dynamic trend display, events and alarms, single line display; standard protocol PMU data links to exchange PMU data with other utilities, and interface with SCADA/EMS systems; event-driven data archiving, monitoring of phase angle, line thermal, voltage stability, power oscillation and damping.

Key benefits of PSGuard Wide Area Monitoring System



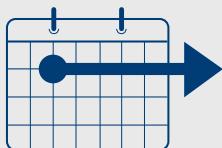
Increased system stability

Early detection of incipient power system instabilities enables early deployment of counter measures, preventing disturbances from spreading and significantly reducing outage costs.



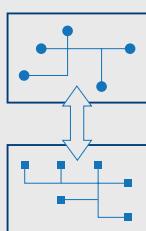
Improved adaptability

Multiple system requirements such as different data rates can be accommodated. Users can also select options best suited to their needs, resulting in best-fit solutions.



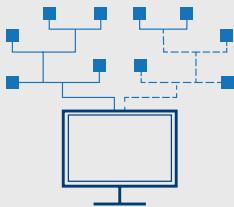
Future-proof

ABB's commitment to standard and open communications for wide area monitoring systems creates future-proof, interoperable solutions fully compatible with future extensions. PSGuard is fully compliant with IEEE standards for power system protection, control and monitoring, synchrophasor measurement and data transfer.



Increased interoperability

Standard compatibility enables the interface to communicate with third party systems, providing increased flexibility through unrestricted ability to combine different products or systems, now and in the future.



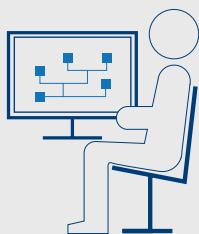
Improved scalability and flexibility

Improved system scalability and flexibility because functionalities can reside on a single server or distributed servers, enabling either centralized or distributed approaches.



Increased capacity and profitability

Instability limits calculated online can increase power line transmission capacity, while maintaining network stability and security, for increased profitability. By enabling transmission lines to safely operate closer to their limits, more power can be transmitted over existing lines, deferring installation of new lines.



Simplified system management

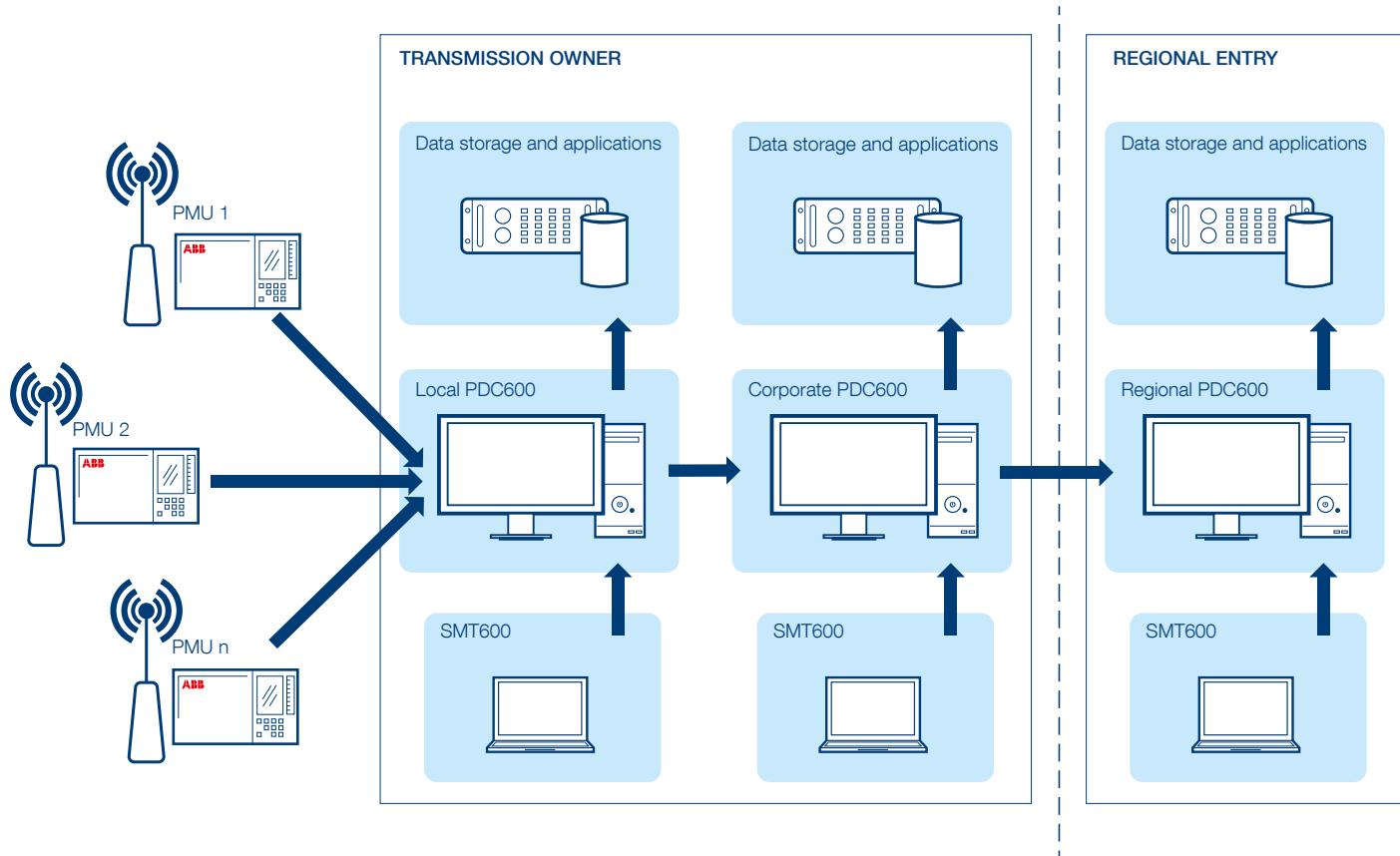
Operators receive timely online information about power system status; operation and handling is significantly simplified in interactions with other systems.



High performance data transfer

Optimized communication bandwidth results in high efficiency using existing infrastructure, made possible by compact data packets for real-time transmissions.

Wide Area Monitoring System enablers



PDC600 – Phasor Data Concentrator

PDC600 is a Phasor Data Concentrator based on state-of-the-art communication developments for synchrophasor applications. It is designed for a variety of Wide Area Monitoring applications, from simple to sophisticated. The high

performance PDC600 meets the needs of the most advanced Wide Area Monitoring applications, while providing a seamless communication interface for the pure exchange of synchrophasors.



PDC600 – features, benefits and value

ABB's up-to-date Phasor Data Concentrator (PDC) is fully compliant with the IEEE C37.118-2011 international standard for synchrophasors, as well as PDC guide IEEE C37.244, while the unit's compatibility with other vendors enables future extensions, and reduces upgrade costs.

The PDC600 solution improves scalability for hierarchical systems (functionality can reside on a single server or distributed servers), and is capable of delivering centralized or distributed architectures and solutions. This cost effective solution meets customer needs without compromising functionality.

A local PDC in substations or regional control centers can serve as optional data storage in the event of telecommunication failure. Data aggregation at the substation level accommodates different system requirements, such as data rate, providing engineering of a single device/function for several clients, and data frames with different requirements.

Increased system flexibility means less dependency on core system components and scalable system solutions, from small to more advanced.

The PDC600 features simplify system interactions and management, which means interaction with system components can be oriented to specific tasks, and configuration management is simplified by working with specific components. Simplified engineering and system maintenance lowers the risks during real time operation.

SMT600 Synchrophasor Management Tool

SMT600 is the Synchrophasor Management Tool for the configuration, parameterization, monitoring and supervision of the PDC600 Phasor Data Concentrator. The tool's modern interface provides an easy-to-handle user experience for the most complex applications. Simple, guided steps enable the user to quickly prepare and manage synchrophasor data for different types of applications.

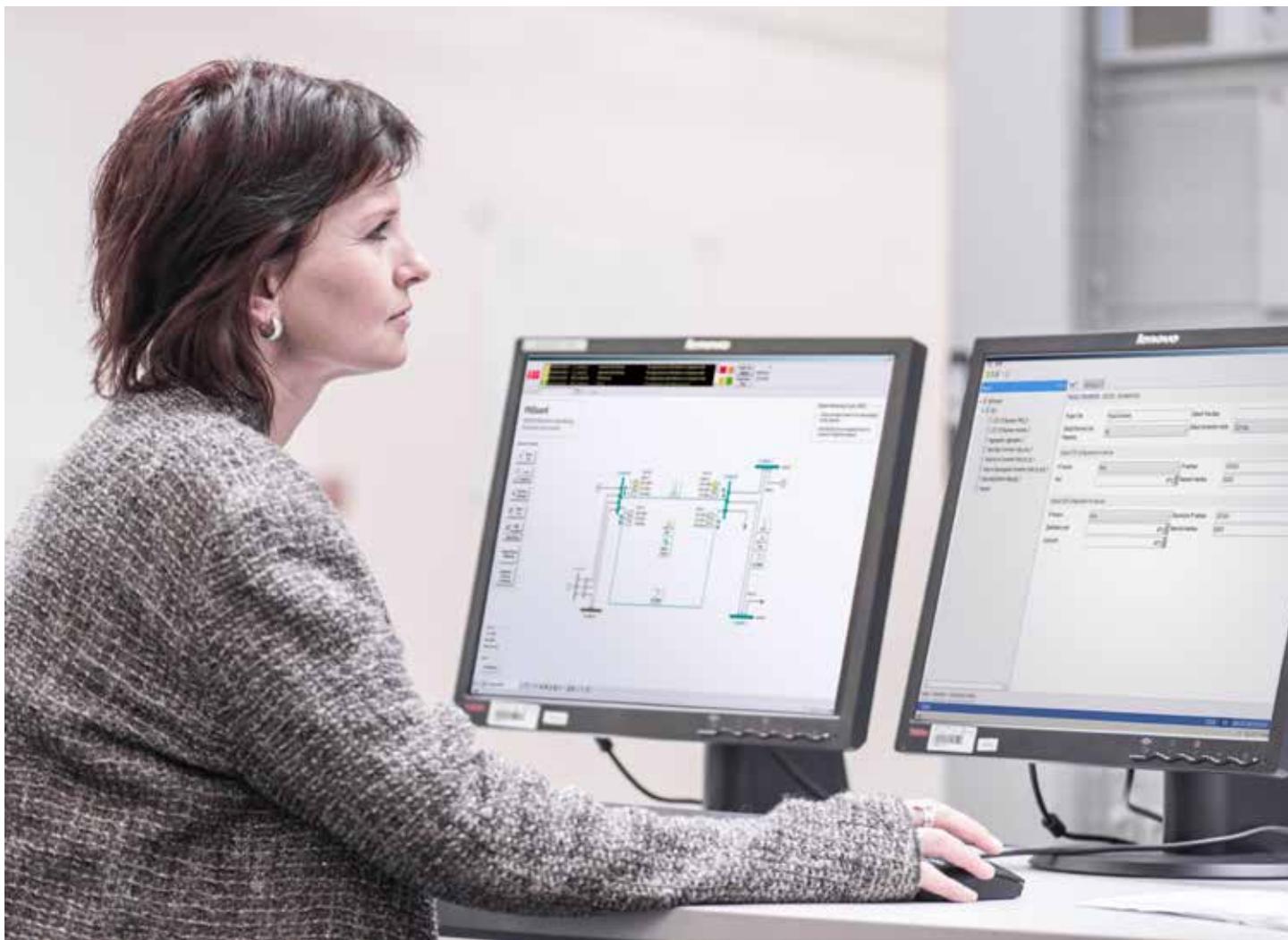
SMT600 – features, benefits and value

The SMT600 Synchrophasor Management Tool configures separate data streams and clients, so independent data streams can be oriented to different clients and applications, and several data streams can contain different data for different purposes. This feature optimizes communication bandwidth, providing security and reliability.

ABB's gateway server communication configuration provides easy signal selection shared among horizontal (partners) or vertical (upstream PDC) communication, with higher data security and reliability and optimized data for applications.

The SMT600 provides online monitoring of PMU communication status for troubleshooting and maintenance purposes. This feature offers immediate awareness in the event of problems, as well as lower maintenance and operation costs, and simplified operational procedures.

The configuration consistency check feature provides security when deploying new configurations, increasing system stability.



RES670 Phasor Measurement Unit

For real-time and efficient wide area power system monitoring, protection and control

The RES670 IED (Intelligent Electronic Device) provides power system AC voltages and currents as phasors – up to 32 analog phasors in two different data streams, with capacity to send single-phase phasors or positive, negative, zero sequence values, or all of them. Reference for the phase angle is the Global Positioning System – GPS or IRIG-B.

RES670 – features, benefits and value

ABB's RES670 Intelligent Electronic Device (IED) is compliant with IEEE C37.118-2011/2014, the international standard for synchrophasors, and provides a future-proof design that helps customers avoid added upgrade costs, such as third party compatibility to reduce equipment needs and simplify engineering.

The RES670 features single phasor data streaming, enabling new applications such as single phase state estimation to improve state estimation and deliver make power system operations more reliable.

Active and reactive power data streaming is available, enabling power measurement directly from the PMU at the sensor point, so there is no need to calculate power in the PDC, or elsewhere. The result is more accurate measurements, more reliable power system operations and simplified engineering at upper levels that reduces engineering time and implementation costs.

The analog data streaming feature enables milliampere input signals to be sent by PMU for control purposes, eliminating the need for other means of transducer signal transfer, which reduces the amount of additional hardware needed, saving costs and increasing MTBF rates.

The RES670 provides variable rack sizes (1/2, 3/4, 1/1 19") resulting in flexible hardware selection that can save space and optimizes hardware needed for a station- or bay-oriented approach, reducing costs and footprint.

Backup protection capability results in a stand-alone and station-oriented PMU, which can also be used for backup protection, lowering costs for backup protection functions.

In addition, two independent synchrophasor data streams in one PMU make it capable of simultaneously reporting time synchrophasor data with two different report-rates, and/or different performance classes (P/M), and/or data types. This helps to lower implementation costs in advanced utility or application requirements, as no extra PMU is required.



PSGuard functionality

Basic monitoring applications

The PSGuard operator workplace provides powerful views of a wide area system, enabling the system operator to easily and quickly identify network disturbances in real time, as well as evaluate past events for post-mortem analysis.

System Supervision

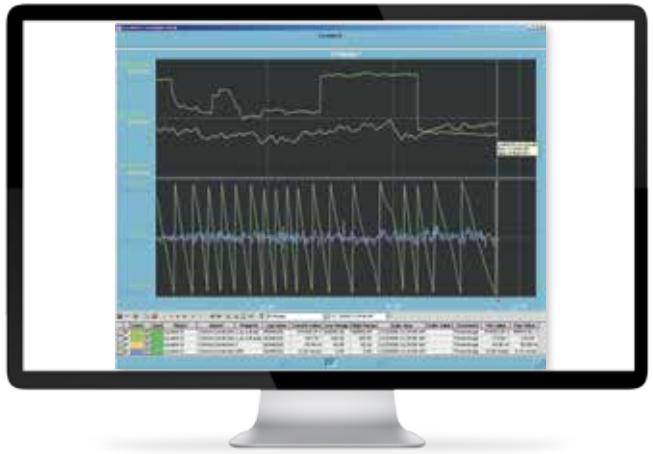
PSGuard system supervision enables operators to navigate to Phasor Measurement Units (PMUs) directly, and provides all necessary information to supervise PMU condition and view at a glance PMU condition, communication status and GPS synchronization.



Dynamic Trend Display

The PSGuard trend display enables operators to observe the development of system events in real time. The trend display provides access to historical data, and can be selected for all elements in the system. Standard functions of PSGuard trends include:

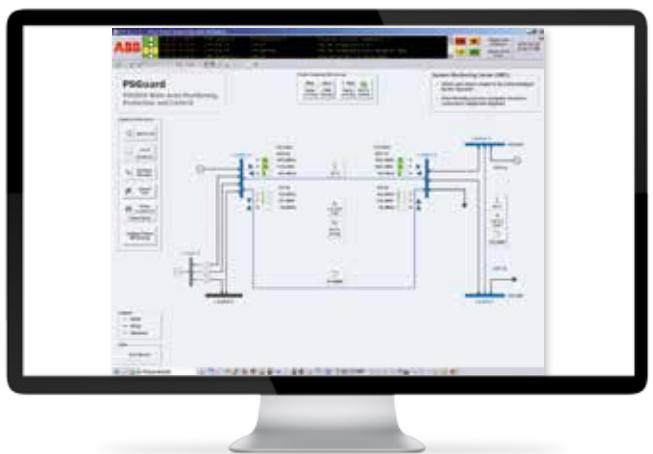
- Individual axis scaling
- Adjustable time scope
- Online integration of new traces
- Zooming, time and value rulers, etc.



Trend views are available for all PSGuard application outputs, as well as raw measurement values. Which means that every measured and every calculated value can be analyzed and compared visually over long time spans, in real-time or offline.

Events and Alarms

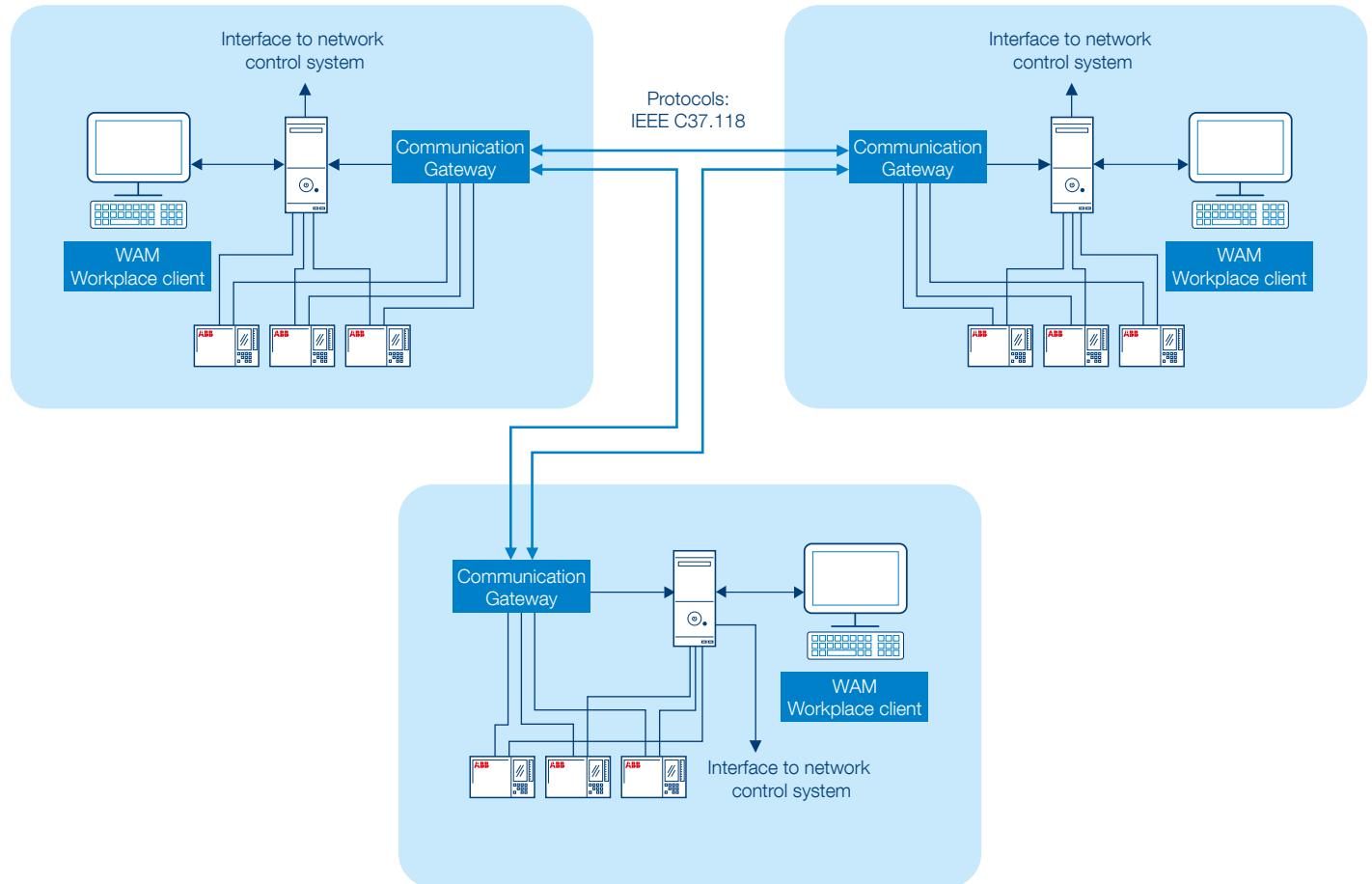
PSGuard provides notifications through its integrated events and alarms pane. User-defined events and alarms provide the operator with information needed to react immediately to events taking place within the system.



Single Line Display

The PSGuard single-line representation provides the operator with a power system overview, including complete access to detailed wide area monitoring information using easy-to-understand symbols and buttons.

Communication applications



Data Storage and Export

Data storage is a key function of the PSGuard system, which archives historical process data from PMU devices and Wide Area Monitoring applications. Data sets can be stored in different resolutions and time spans. Connections to local and remote History Data Access (HDA) servers are supported, enabling a flexible and expandable architecture. PSGuard data export enables exporting data from the history database to external applications, including comma-separated value files (CSV), allowing further processing and analysis of datasets using these applications.

Communication Gateway

The PSGuard communication gateway enables transmission system operators to exchange PMU data with other utilities, and provides the following benefits:

- One central PMU data access point for other utilities, instead of connecting devices to a common network
- Control of access rights to data
- Control of data that is provided to other utilities by selectable transmission of PMU signals to the clients; for example, signals like voltages can be included and restricted data like currents can be excluded from the data exchange
- Control of update rates for each client, to optimize communication bandwidth

Interface Manager

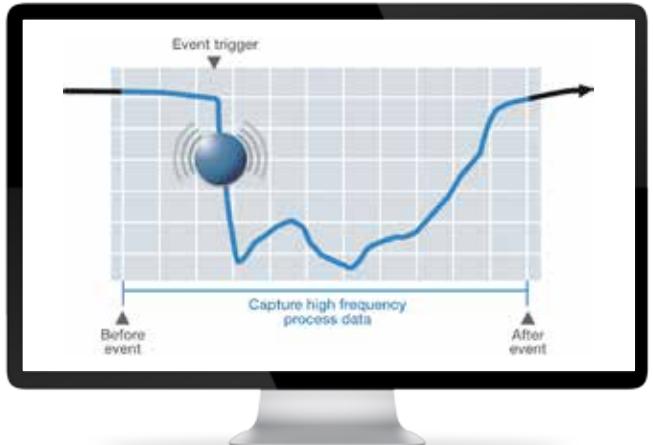
The PSGuard interface manager provides operators with PMU measurements, WAMS application data and alarms from PSGuard in SCADA/EMS systems. The PSGuard interface is platform-independent and enables data access from different SCADA/EMS systems. When connecting PSGuard with a Network Control Center (NCC), these systems regard PSGuard as a gateway device, which enables easy and fast integration. The Interface Manager provides data to SCADA/EMS with an update rate that can be configured down to the supported update rate of the SCADA/EMS system.

PSGuard functionality

Advanced Wide Area Monitoring applications

Event Driven Data Archiving

The PSGuard Event Driven Data Archiving application (EDDA) is the wide area transient and disturbance recorder. It records system-wide disturbances in a power grid, and flexibly captures event-related PSGuard high-resolution data in an archive, which contains the range of data before and after a detected event. This ensures all necessary data leading to an event is recorded. Archiving times can be flexibly configured by the operator.



Phase Angle Monitoring

The Phase Angle Monitoring (PAM) application facilitates monitoring of network stresses caused by heavily loaded lines, and provides operators with real-time information about voltage phase angle deviations between two locations. For example, this is a decisive factor in the successful reclosing of transmission lines. PAM helps utilities improve voltage control in their power systems. The application enables utilities to safely operate power-carrying components closer to their design limits, without jeopardizing stability, security or reliability.



Voltage Stability Monitoring

The Voltage Stability Monitoring (VSM) application provides power system operators with valuable online information to assess present power margin with respect to voltage stability. A power margin is the amount of additional active power that can be transported on a transmission corridor without jeopardizing voltage stability. This monitoring functionality and its outputs are intended as decision support for operators.

Operators may improve voltage stability by means of generation rescheduling, reactive compensation, blocking tap changers in the load area or, in extreme cases, load shedding. The VSM application is designed to monitor transmission corridors and deliver the dynamic current, voltage phasors and resulting calculations in real time.



Line Thermal Monitoring

Due to the high cost of new transmission circuits and transmission bottlenecks, the static thermal ratings of transmission lines are now being challenged by many utilities as overly conservative. As an alternative, ABB offers utilities a real time thermal rating application for transmission lines, providing access and a means to increase the available transfer capability of transmission circuits. The Line Thermal Monitoring (LTM) application provides accurate information about thermal conditions of the transmission circuit. Dynamic rating of a transmission line is considered a smart alternative to the cost of adding a new transmission line, without the risk of overheating an existing transmission line.



Power Oscillation Monitoring

Power Oscillation Monitoring (POM) is a PSGuard application used to detect power swings in high-voltage power systems. With POM, operators are immediately aware of oscillations in power systems. The POM algorithm processes selected voltage and current phasor inputs, and detects various power swing modes, which can lead to angular instability causing disturbances. POM quickly identifies the frequency and damping of swing modes, and provides improved power system visibility.



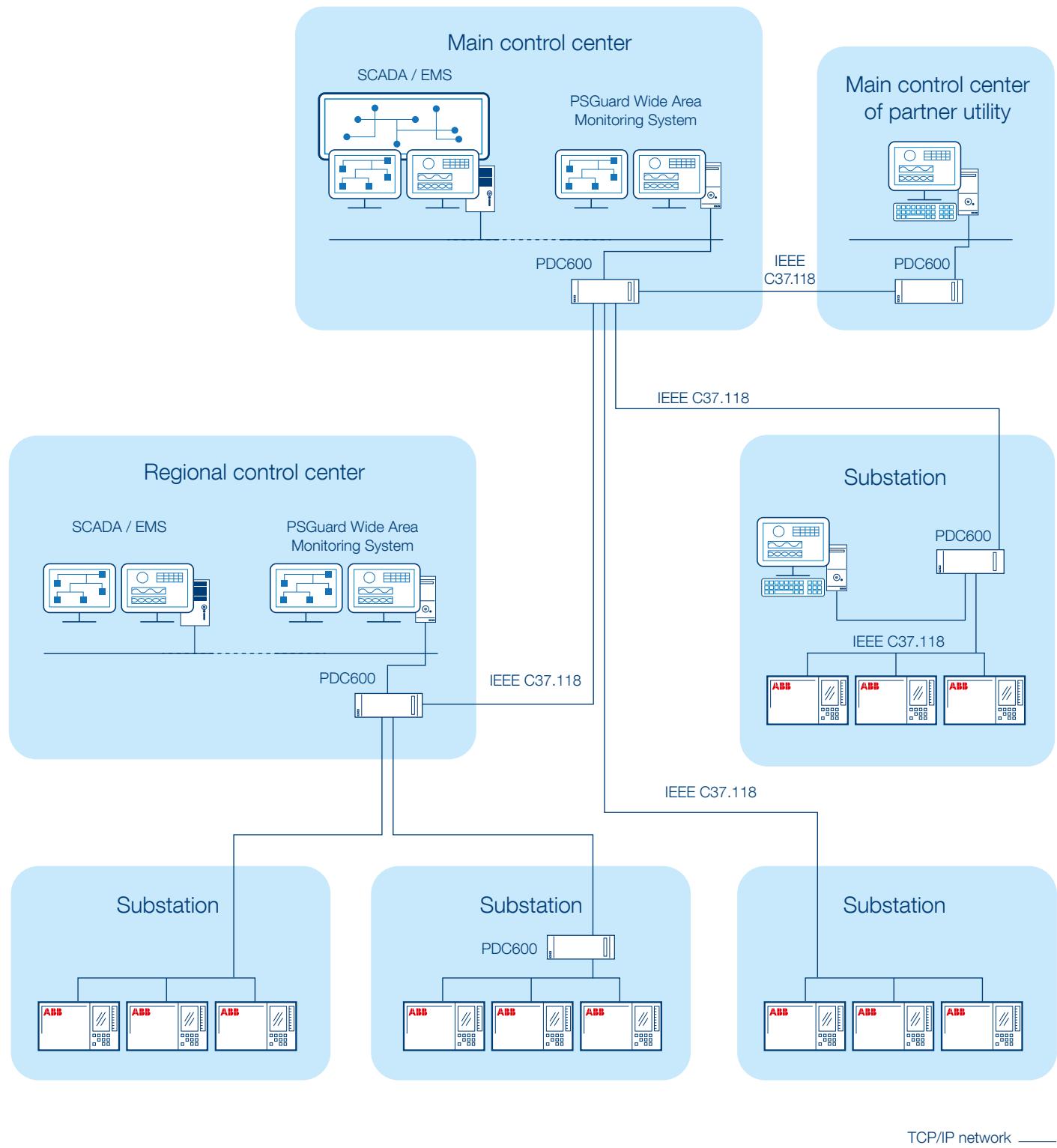
Power Damping Monitoring

Damping inter-area oscillations is a major concern for many power system operators today. Consequently, the detection and characterization of such oscillations has become an important application area of Wide Area Monitoring Systems. The PSGuard Power Damping Monitoring (PDM) application utilizes a new method for detecting and characterizing oscillations, using real-time synchronized measurements from multiple points in the power system. PDM can detect and characterize the damping behavior of oscillating modes using measurements during ambient conditions, providing operators with an effective early warning system before a disturbance in the power system triggers instability. Moreover, PDM characterizes the level of activity of each mode at various measurement points, which allows the power system operator to identify which components of the power grid are participating in the oscillation.



Wide Area Monitoring System

System overview



WAM solutions from ABB

Experience that counts



ABB's unrivalled expertise, technologies and global experience in power systems deliver best-in-class solutions for all of your applications.

Competent service and support in all project phases

With a full scope of services and a global support network comprising more than 100 countries, ABB technology and expertise can help you reap the full benefits of your investment across the power system life cycle.

- System design specification
- Engineering, system integration and commissioning services
- Factory acceptance tests
- Customer training
- Service and support contracts

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