Industrial IT for Substation Automation & Protection
Exploit the potential of ABB substation automation

**Improve your performance**
In view of the increasingly competitive arena where power providers are facing significant pressure for greater system reliability and improvement of customer satisfaction, the focus is usually placed on cost reduction for better performance.

Upgrading older generation protection and control systems with modular, scalable and pre-engineered ABB substation automation (SA) solutions offers new opportunities to reduce your operating and maintenance costs and to work your plants harder with the aid of the monitoring of the condition of circuit breakers, power transformers, etc.

**Accelerate the fixing of problems**
Your engineers have often struggled with the fact that too little data was available when they attempted to analyse problems within your power systems.

ABB SA solutions comprise intelligent electronic devices (IED) for protection and control with integrated sequence of event and disturbance recorders as well as dedicated fault recorders. They collect, process and transmit data and information for the faster location and fixing of problems.

**Be more responsive**
Operating in deregulated electricity markets, you are facing the challenge to extend or at least to maintain your customer base. This can only be achieved if your organization is more responsive to the customer’s needs with regard to competitive tariffs and reliable service than your competing power providers are.

ABB SA solutions reduce customer outages by identifying incipient faults, managing autosectionalizing, and autorestitution of power, thus improving reliability and availability of supply as well as increasing revenues.

**Enhance your operators’ capability**
In the case of transient power system instabilities, your operators can suddenly be faced with rapid voltage collapse or out-of-step conditions, which may cause cascading tripping and wide area disturbances.

There are three areas where information technology can contribute significant benefits in terms of advanced power system management.
1. Enhanced power system operation, which results in higher reliability of power supply.
2. Substation automation which assures higher availability and flexibility of power supply.
3. On-line power system monitoring to work plants harder and to save operation and maintenance costs.

**Industrial IT** is the ABB commitment to the real-time integration of automation and information systems across the business enterprise.
IndustrialIT for substation automation

Utility performance improvement

Empower your RTU-based remote control
In terms of acting as a slave to a SCADA master station, ABB SA systems enhance the role of a remote terminal unit (RTU) from that of a centralized data sampling and collecting device to a more powerful system of distributed IEDs. The data retrieved are processed in the substation to produce condition-related information, which remain stored in the substation and will only be relayed to the SCADA master or an engineering/maintenance office upon request.

The idea is to enable access to data from anywhere in the corporate business to any IED installed in the substation via corporate Intranet or WAN. You may even want to provide major customers with limited access to data that may be relevant to them.

Rely on our experience
ABB as market leader in the automation and protection business has an outstanding reputation around the world for supplying innovative and cost-effective solutions for SA including protection.

With this vast experience as background, ABB has created a new comprehensive range of key solutions for SA. It includes scalable systems comprising standard packages for station level systems and bay level solutions for control, automation, protection and monitoring.

Achievements for improved utility performance
- Faster power restoration
- Reduced outage times
- Improved power quality
- Increased revenues
- Lower losses of deliveries
- More satisfied customers
- Higher profits
Key solutions for any application

Solutions for substation automation (SA) reflect the structure and requirements for reliability and availability of a specific transmission or distribution substation. At the station level, they comprise substation automation systems (SAS) and/or substation monitoring systems (SMS). On the bay level they include a range of application-specific solutions for control (BCS), automation (BAS), protection (BPS) and monitoring (BMS) of lines, transformers, cable feeders, bus couplers, and bus section couplers for different busbar configurations.

Solution packages
In order to achieve cost-effective modular scalable systems, the following proven packages have been defined:

1. Substation automation system (SAS): comprising station computer for substation monitoring and control, gateway for the communication with control centers, peripherals, station bus and inter-bay bus.
2. Substation monitoring system (SMS): comprising station computer for substation monitoring, data evaluation and processing.
3. Bay control solution (BCS): containing IEDs for control and interlocking as well as HMI for local control.
4. Bay automation solution (BAS): containing IEDs for automation functions, e.g., load-shedding, high-speed busbar transfer, power restoration, etc.
5. Bay protection solution (BPS): containing IEDs for protection, with integrated disturbance recording and protection monitoring functions.

Abbreviations

<table>
<thead>
<tr>
<th>Abbreviations</th>
<th>Description</th>
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<tbody>
<tr>
<td>SA</td>
<td>Substation automation</td>
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<tr>
<td>SAS</td>
<td>Substation automation system</td>
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<tr>
<td>SMS</td>
<td>Substation monitoring system</td>
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<tr>
<td>BCS</td>
<td>Bay control solution</td>
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<td>BAS</td>
<td>Bay automation solution</td>
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<td>BPS</td>
<td>Bay protection solution</td>
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<td>BMS</td>
<td>Bay monitoring solution</td>
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<td>UPS</td>
<td>Unit protection system</td>
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Scalable systems

Various system types have been defined to fulfil the wide range of customer requirements:

- Substation monitoring system (SMS 530) for data acquisition, evaluation and processing.
- Basic substation automation system (SAS 500/510) for remote substation basic control and monitoring.
- Enhanced substation automation system (SAS 530/550) with separated gateway and single/redundant station HMI.
- Advanced substation automation system (SAS 570) with redundant station HMI and redundant gateway.

For further details please refer to the relevant solution descriptions.
Key to the right application

Station level systems are easy to use and to adapt to customer-specific requirements. Our modular scalable systems reflect the typical needs and availability aspects for the following range of applications:

Basic SAS is recommended for remote and/or local basic control and monitoring of small up to medium-sized subtransmission and distribution substations for power generation, power distribution, and industrial plants.

The main system features are:
- Substation gateway, or
- Single station HMI
- Single inter-bay bus architecture
- Few and highly reliable components
- Optional advanced control and monitoring

Enhanced SAS is recommended for remote and/or local control and monitoring of high voltage transmission substations.

The main system features are:
- Substation gateway and independent HMI
- Single or redundant HMI
- Multilevel communication architecture
- Dedicated station and inter-bay bus
- Optional advanced control and monitoring
- Optional separate highly reliable gateway

Advanced SAS is recommended for remote and/or local control and monitoring of extra high voltage transmission substations.

The main system features are:
- Redundant substation HMI
- Redundant gateway
- Multilevel system architecture
- Redundant station bus
- Optional advanced control and monitoring

Note: Advanced SAS may also be used for complex distribution substations of high importance in power plants or industrial plants.
### Key to the right application

<table>
<thead>
<tr>
<th>Customer requirements</th>
<th>SAS 500</th>
<th>SAS 510</th>
<th>SAS 530</th>
<th>SAS 550</th>
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<tr>
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<td>Extra High Voltage Transmission (&gt;400 kV)</td>
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<td>Local and remote with priority on remote</td>
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**Key to the right functionality**

**Bay level solutions** are modular scalable and proven solutions, easy to maintain and to adapt to specific user requirements. They contain ABB's comprehensive range of multi-functional intelligent electronic devices (IED) and comply with the high safety and reliability standards for control, automation, protection, and monitoring of substations for system voltages up to 800 kV.

The main features are:
- Compact hardware design
- Software library for protection and control
- Programmable application-specific logic
- Continuous self-supervision, diagnosis
- Fully numerical signal processing
- Easy to configure via Windows-based tools
- Direct connection to CTs and VTs
- Time synchronization via inter-bay bus
- Integrated synchro-check
- Integrated event and disturbance recorders
Bay control solutions are made to meet the specific bay operation, safety and interlocking functions. Optimized solutions can be selected according to the system voltage and for single busbar, double busbar or 1½ circuit breaker substation configuration.

Bay automation solutions provide decentralized automated functions. Optimized solutions are available for intelligent load-shedding, for fast power restoration procedures after protection trips and for high-speed busbar transfer.

Bay protection solutions provide the entire range of reliable and selective protection functions. Optimized solutions can be selected according to the system voltage for the protection of lines/cables, transformers and busbars. The integrated disturbance recorders and communication ports allow retrieval of condition-related data from the associated objects.

Bay monitoring solutions to retrieve data and disturbance records from bay protection IEDs, to transform data into information and to provide access for parameter setting.
Transform resources into benefits

Power networks at transmission and distribution level need to be retrofitted and expanded as infrastructures grow, and new industrial, commercial, and residential projects are developed.

The deregulation and globalization in the power industry generates pressure to improve the economy of power system operation, maintenance and life cycle asset management. The challenge for the power company is to work their plants and systems harder while maintaining the power quality and providing excellent service to their customers at competitive prices.

Upgrading the existing networks by implementing modern Substation Automation concepts complemented by efficient Corporate Information Systems is the right approach to exploit the new market opportunities. Such upgraded systems satisfy new requirements for high quality electricity supply in increasingly competitive marketplaces.

Our power process know-how enables us to offer the best solution to meet your functional requirements. It is more cost-effective to specify functionality rather than design details. ABB delivers, installs and commissions high, medium, and low voltage protection and control systems for power companies and industries.

Upgrade steps towards advanced power system management

The application of modern IT solutions with implementing IEDs is the state-of-the-art for new substations. The benefits of advanced power system management can, however, only be exploited if the older generation electromechanic control and protection systems in existing substations are replaced by modern IEDs and if access is provided for data retrieval via modern communication networks.

Even if a modern wide area network (WAN) is available for real-time data exchange, there remains the decision to be made for the most feasible step-by-step refurbishment strategy for the replacement of the older generation equipment. The strategy as outlined opposite suggests nine upgrade options depending on the required scope of functionality.
1. Remote terminal unit (RTU) permits remote control from supervisory control systems (SCADA) in network control centres, and numerical protection offers more functionality and a higher reliability.

2. Central control system with IEDs enhances the functionality of a RTU, and integrated digital fault recording reduces the costs for finding and fixing of faults. Serial links can be used to connect the protection IED with the RTU.

3. Decentralized control system with IEDs close to the primary equipment offers significant cost reduction for secondary cabling, and the data retrieval via modem allows cost-effective maintenance and parameter adaptation from remote.

4. Interaction of IEDs for control and protection via an inter-bus allows more complex control functions to improve the flexibility and availability of substations.

5. Substation automation system enables local operation of substations, comprehensive substation monitoring and the provision of a substation database for data processing.

6. Substation monitoring system enables comprehensive substation monitoring and the processing of data to protection-related information and fault location as well as short reports.

7. Network level system for centralized retrieval and transmission of data enables the maintenance and protection engineer to evaluate data from many substations.

8. Wide area monitoring, protection and control system is applied for advanced power system management, load-shedding and islanding of subsystem to maintain power system integrity.

9. Corporate information system in terms of WAN and broadband technology allows the exchange of data and information between substations, SCADA/EMS and utility back-office in order to insure that the right information is available to the right people at the right time.