



ABB OY DISTRIBUTION SOLUTIONS

# Smart substation control and protection SSC600

Product application examples and features

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**Introduction**



**Customer benefits**









**Centralized protection and  
control features**



**Solution examples**

# Introduction







## Smart Substation Control and Protection SSC600

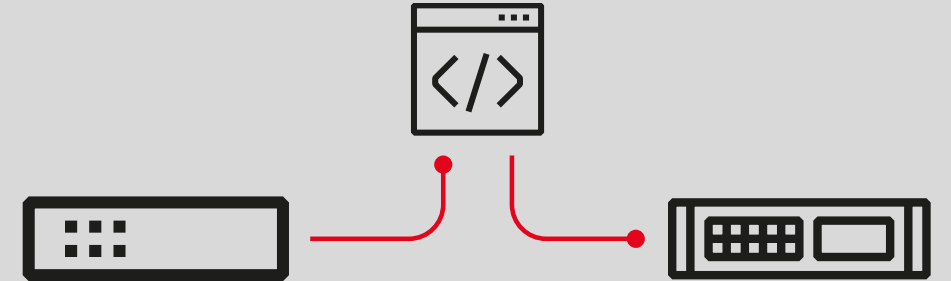
-  **Smart Substation Control and Protection SSC600** incorporates centralized protection, control and monitoring functionalities to offer a superior solution to utility and industrial customers for the entire duration of the substation's life cycle.
-  With software based on existing Relion technology it is designed for a wide range of power distribution applications – from basic feeder protection and control to complex multibay substation applications.
-  The software can be flexibly modified anytime to adapt to changing network requirements.
-  Allows viewing and monitoring processes on substation level from a centralized point.
-  Industrial computer technology allows fast utilization of modern high-performance computing and reliable operation (no moving parts, redundant power supply).
-  Turnkey tested and verified product including hardware and software in the same package.



# Introduction

## Smart Substation Control and Protection SSC600 SW

-  Smart substation control and protection **SSC600 SW** has the same functionality as SSC600 but only the software (no hardware included)
-  Delivered as virtual machine – KVM or VMWare
-  Benefits of virtualization also for the real-time functionalities.
-  All same external interfaces as SSC600 – IEC 61850, IEEE 1588 v2, PRP, WHMI, etc.
-  Freely choose computer – it just needs to fulfill the minimum requirements.
-  Same performance as embedded protection devices – protection speeds, communication latencies, and event reporting.



# Introduction

## Merging units

### Pure merging unit – SMU615

One single unit for all measurements and I/O for a single bay – with standard wiring and design on bay level

Support for both conventional CTs, VTs and sensor technology

- 4I + 3U ( $I_0$  0,2/1A)
- 3Is + 3Us +  $I_0$  (Io 0.2/1A)

IP54 (front) IP20 (rear)

8BI + 6BO + 3HSO



### Intelligent merging units (with backup protection functions)

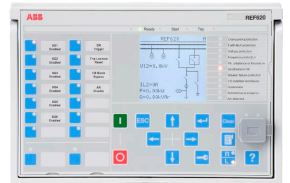
#### REX615

- Up to 7 CTs/6VTs
- 31 I/Os



#### REX620

- Up to 10 CTs/4VTs or 8 CTs/9VTs
- 50 I/Os



#### REX640

- Up to 12 CTs/8 VTs or 10 CTs/10 VTs
- 95 I/Os



# Introduction

## Application package concept

**SSC600 comes with convenient, ready-made application packages that can be flexibly combined to meet application-specific requirements.**

**The available packages support the following applications:**

### **Feeder/line protection**

- Extensive overcurrent and earth-fault protection
- Fault locator
- Distance protection

### **Power transformer protection**

- Protection for two winding power transformers

### **Motor protection**

- Protection of asynchronous motors

### **Power quality measurements**

- Current and voltage distortions
- Voltage variation
- Voltage unbalance

### **Shunt capacitor protection**

- Protection of single Y, double Y and H-bridge connected capacitor banks
- Protection of harmonic filter circuits

### **Interconnection protection**

- Protection of interconnection points of distributed generation units
- Frequency protection

### **On-load tap changer control**

- Position indication
- Voltage regulation

### **Busbar protection**

- Protection against arc flash
- Low impedance-based busbar differential

# Introduction

## IEC 61850-compliant centralized protection and control



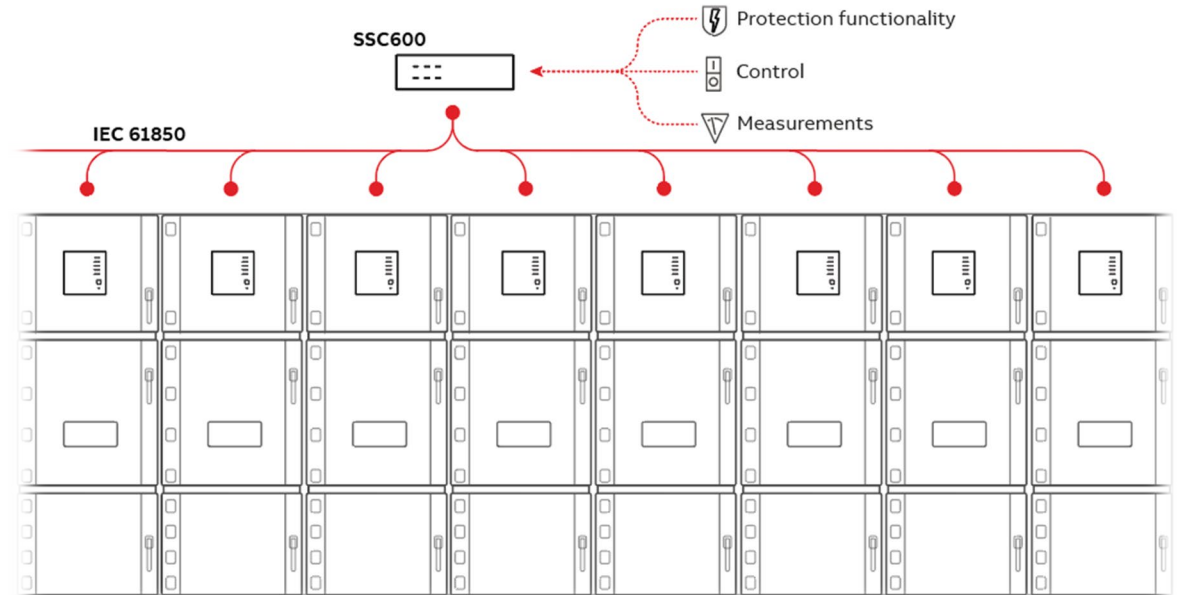
### Customer need

- All settings, configurations and applications centralized in one device
- Dynamically allocate the applications per bay with the possibility to change or adapt at anytime depending on the substation evolution (for instance, a feeder needs to be converted into a transformer bay in a very short time)



### Solution

- SSC600 combined with IEC 61850 merging units (MU)
- All settings, configurations and application in one device
- Any capable protection relay suitable as backup time master
- Substation gateway doubles up as human-machine interface (HMI)
- Combined or separated IEC 61850 network for process and station bus
- System visualization using SSC600 and its Web HMI (WHMI)
- Time synchronization via the IEEE 1588 v2 GPS (Global Positioning System) master



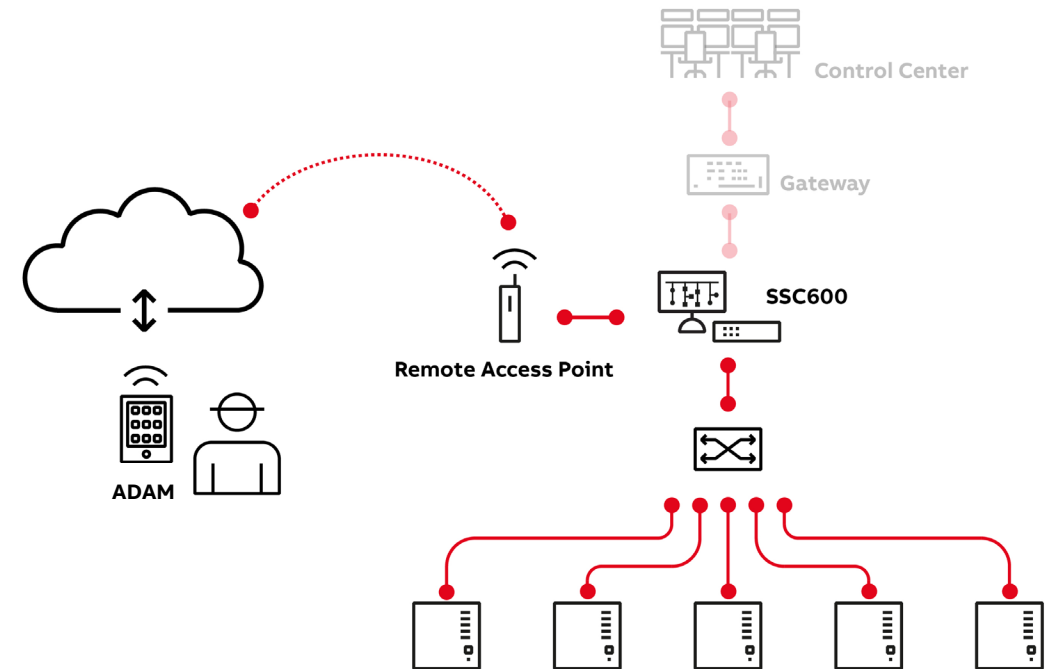


# Introduction

## ADAM fleet management solution

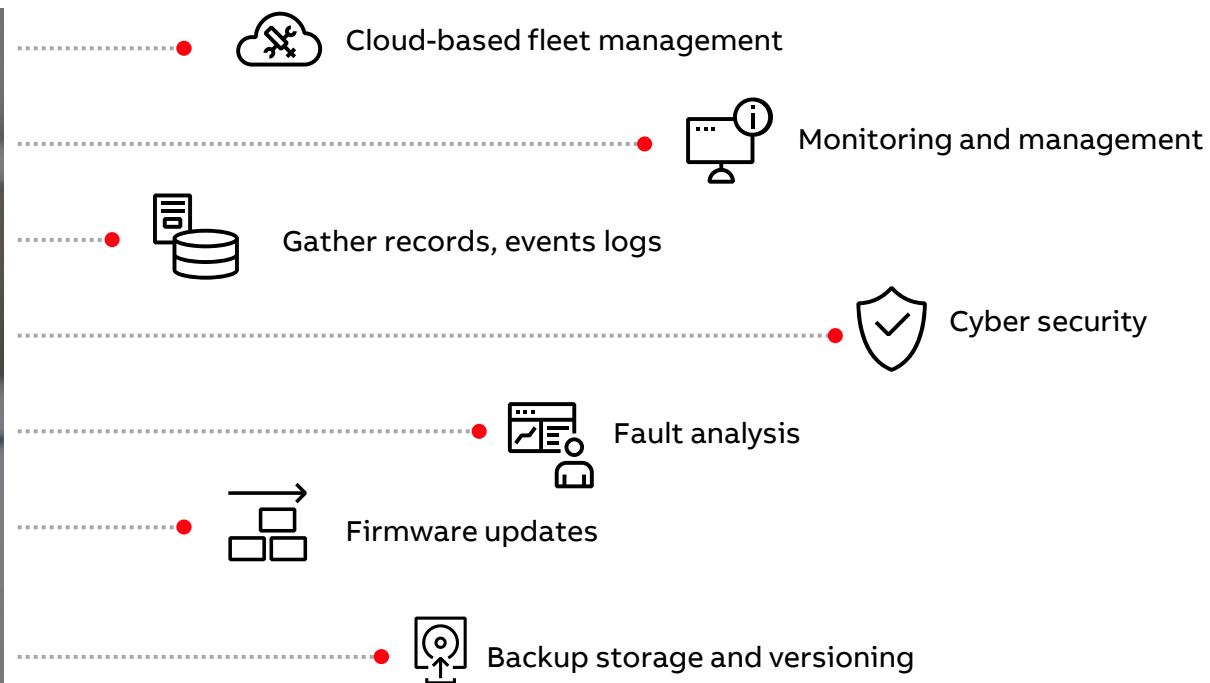
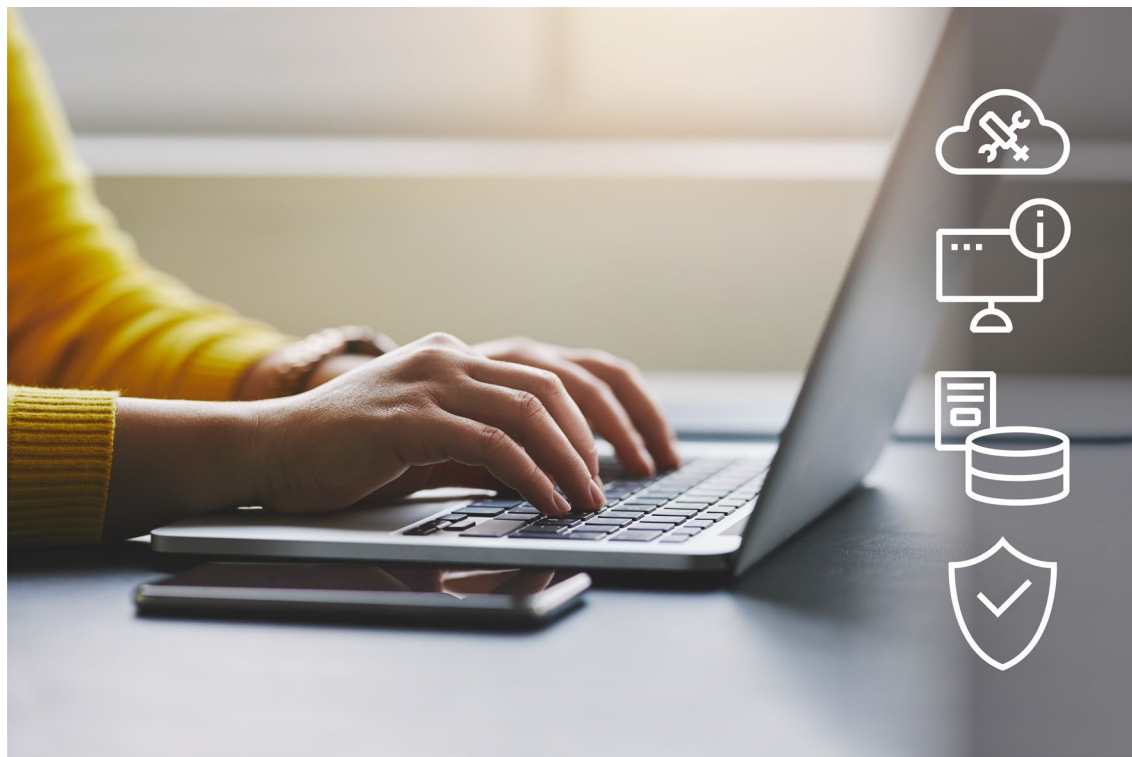
### Cloud environment

- **Solution built around the software- and service-oriented approach to protection and control functionality in power distribution substations**
- **Added functionality** offered by utilizing cloud services
  - Fleet management
  - Remote updates
  - Remote diagnostics
  - Asset management



# Introduction

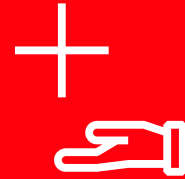
## ADAM at a glance



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**Centralized protection and control features**

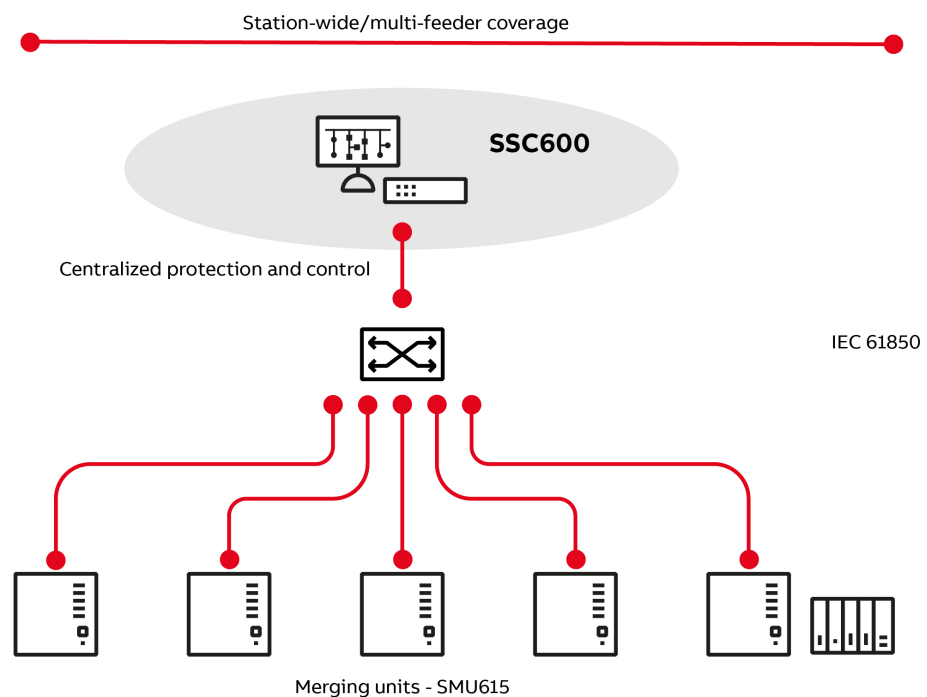


**Solution examples**

# Customer benefits

## Innovative application and design

- A novel approach to protection and control in distribution networks – centralizing all protection and control functionality in one single device on substation level
- New and existing industry-leading products and functionality enabled across a wider field of application, such as ABB digital switchgear
- All needed protection and control functionality combined into this solution for wide application coverage
- New business model for continuous support and digital services that add value to the entire life cycle of the substation



# Customer benefits

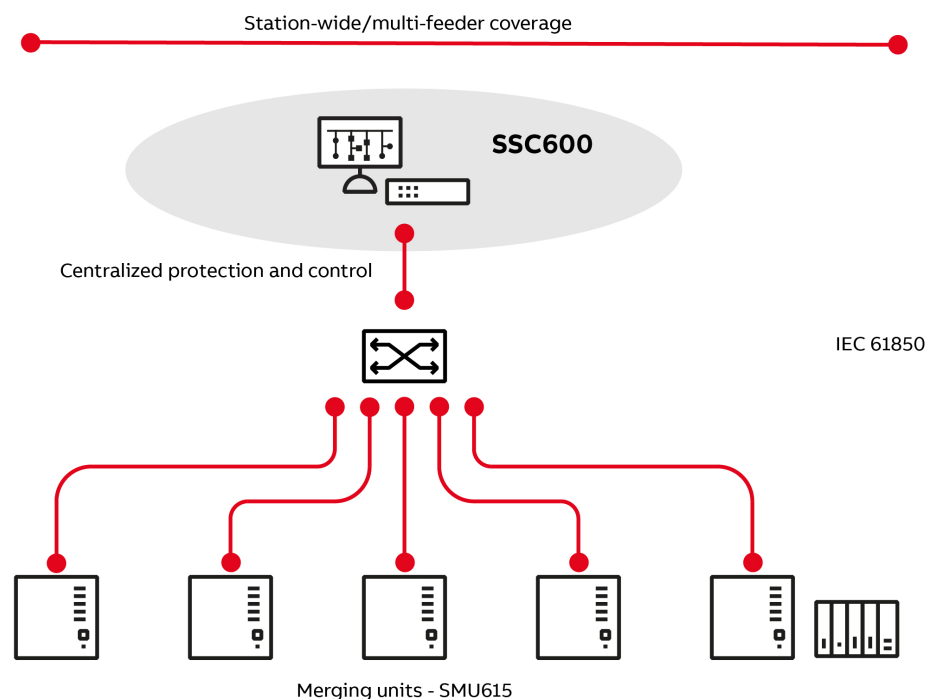
## Protection flexibility for changing power grids

Flexibility with centralized protection and control functionality to build an optimal power distribution protection scheme for reduced network complexity

### Flexibility and freedom

- Adaptation to changing network environments
- Extension of the centralized protection and control solution at any time with minimized engineering (new feeder or new functionality)
- Extension of the installation life cycle by updating and adding functionality to the existing protection scheme (protection always according to most recent innovations)

Minimized process downtime during maintenance work thanks to ease of device replacement and minimized engineering



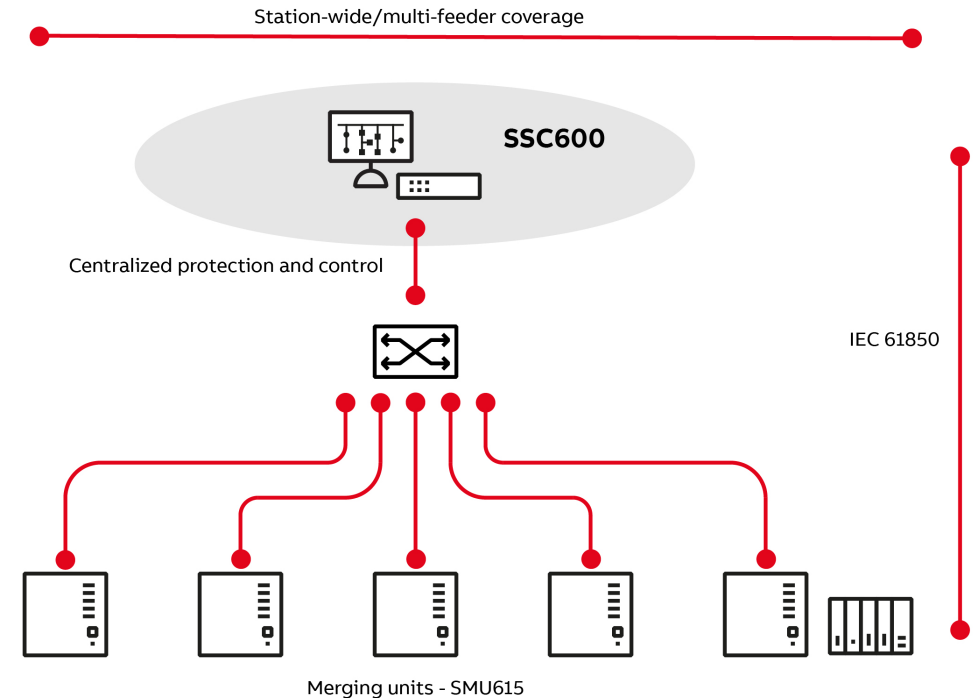
# Customer benefits

## Ease of use for increasingly complex systems

The solution paves the way for minimized process downtime.

- Better visibility of substation processes as data is concentrated at the substation level thanks to centralized protection and control, processed and provided to even higher-level processes
- Reduced network complexity with all protection and control functionality centralized in one device
- More effective and efficient process management because of the increased process visibility at substation level

Easy device addition or replacement with minimized engineering effort



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**Introduction**



**Customer benefits**



**Centralized protection and  
control features**



**Solution examples**

# Centralized protection and control features

## Centralized fault analysis



### Customer need

Substation-wide visibility with monitoring of network faults from a centralized point

All substation-related fault data in one place



### Solution

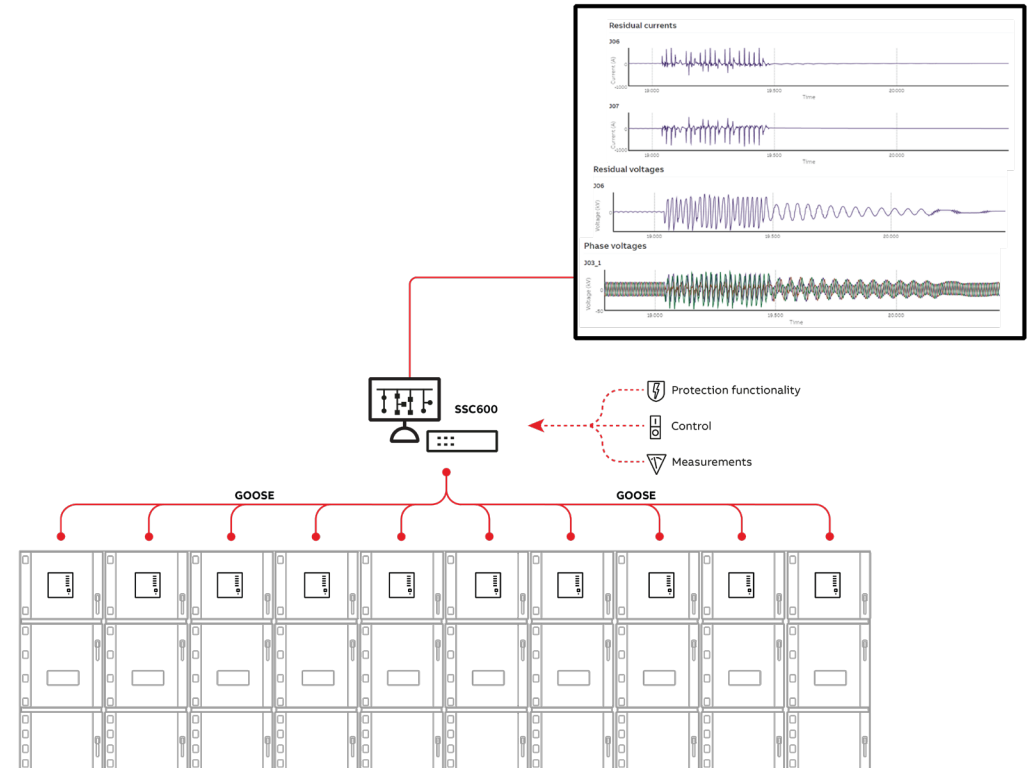
Disturbance recordings covering the whole substation

- Recordings of all received IEC 61850-9-2 LE sample streams with 80 samples per cycle (up to 30 streams)
- Recordings of up to 512 Boolean signals
- Storage space for thousands\* of COMTRADE files
- Maximum recording length 60 seconds

Sequence of events (SOE) for the whole substation

Fault record data of all protection events

Trigger recordings with dedicated anomaly detection function





# Centralized protection and control features

## Centralized substation-level HMI



### Customer need

Centralized substation-level HMI

- Station-wide process visibility
- Annunciator functionality



### Solution

Ability to monitor and control the whole substation via SLDs on the WHMI

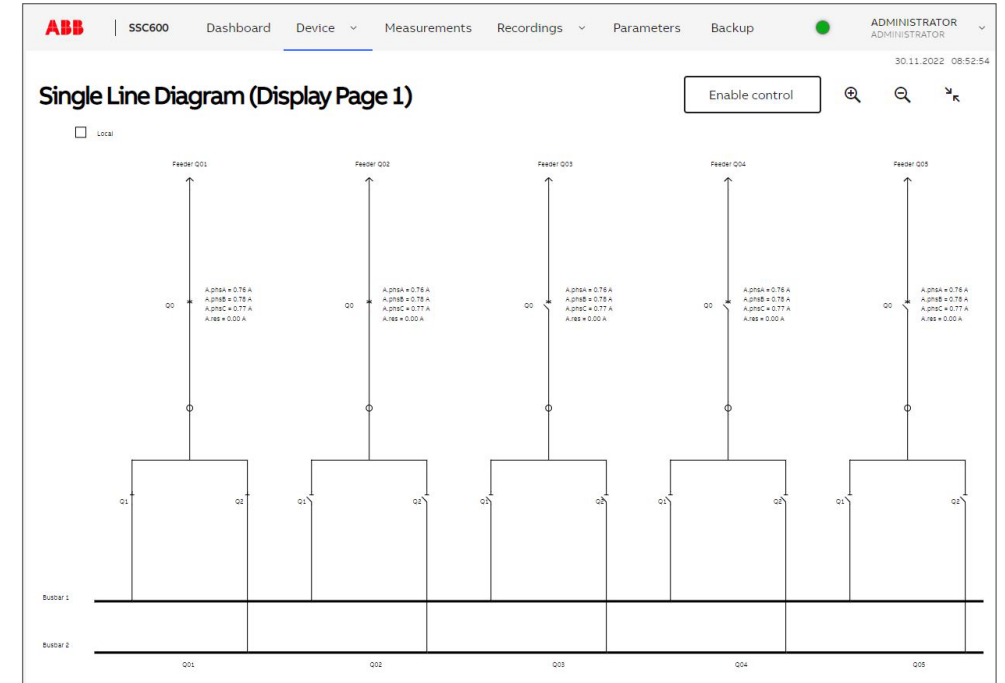
Easy access to events, fault records, disturbance recordings, settings and measurements

Alarm annunciator functionality with remote I/Os:

- Up to 100 alarm LEDs
- Capability to receive up to 1,600 GOOSE values and use them in logics

Possibility to add ZEE600 for a more comprehensive station HMI

- Full alarm handling with acknowledging
- Busbar coloring
- External logic processing (in addition to SSC600 logics)
- Data historian



# Centralized protection and control features

## Easy-to-use interface



### Customer need

Easy-to-use interface without using the relay setting and configuration tool, PCM600

Embedded local HMI (LHMI) functionalities



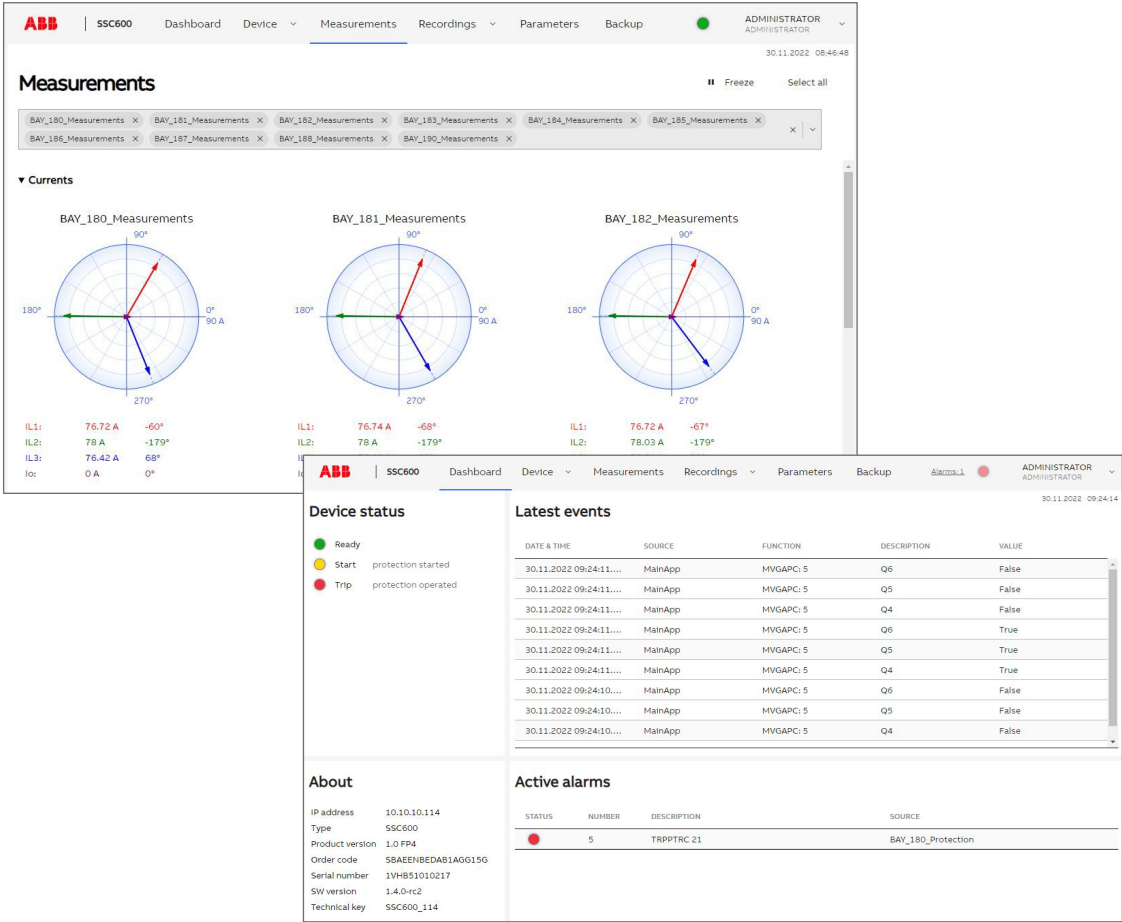
### Solution

Intuitive WHMI for easy navigation

Control of switching equipment

Possibility to read and write parameter setting values to SSC600 via the WHMI

Possibility to print parameter setting values via the WHMI



# Centralized protection and control features

## Centralized logics and configuration



### Customer need

Flexibility to customize protection application for specific needs

Easy-to-use PLC engineering interface

Possibility to graphically troubleshoot and monitor programmable logics

Centralized place for large logics with protection class operation reliability and performance



### Solution

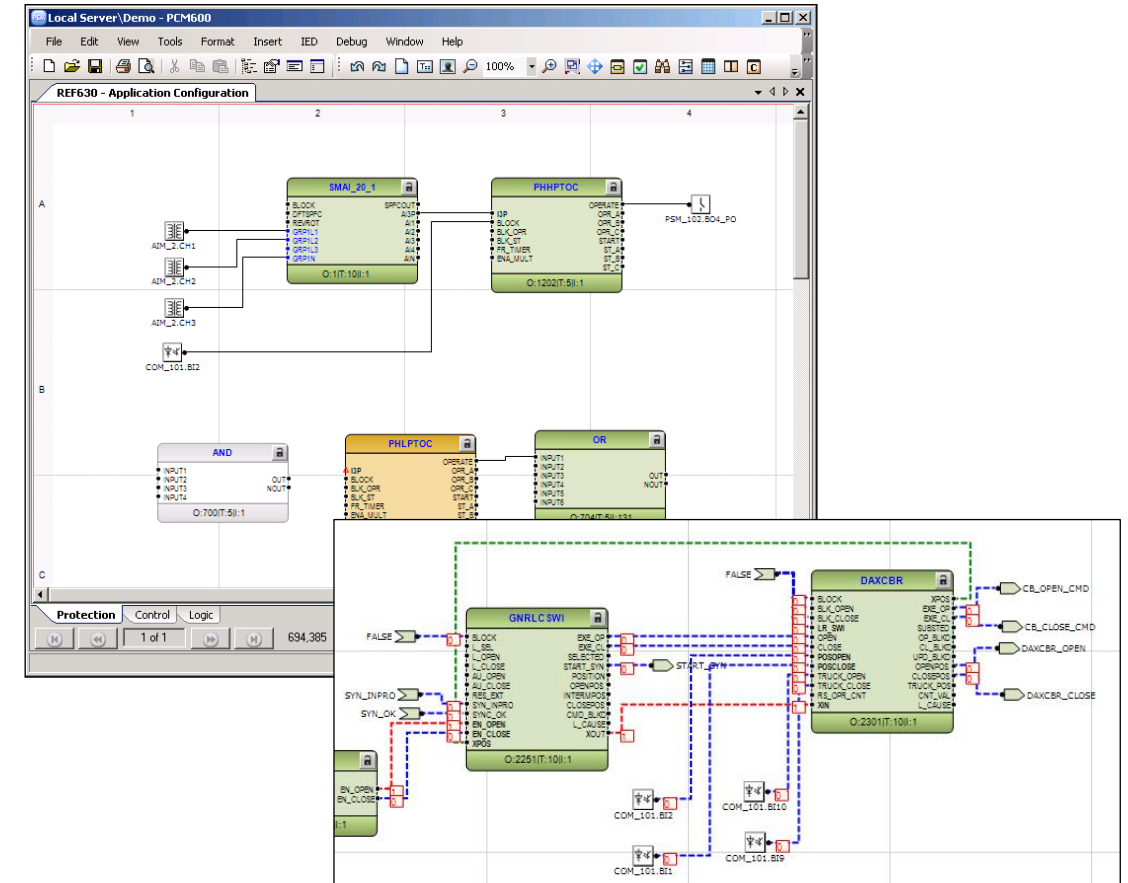
Extensive logical programming functionality with various logic functions

Easy-to-use graphical application configuration interface in PCM600

Online monitoring of the complete SSC600 application with PCM600

Ability to receive hundreds of statuses and use them together with thousands of logical gates for highly demanding applications

All station-level and bay-to-bay logics done centrally, for instance, interlockings in one single configuration



# Centralized protection and control features

## Ease of replacement via configuration backups



### Customer need

Standardization of equipment

- Engineering templates for easier and faster engineering
- Configuration backup for fast device replacement



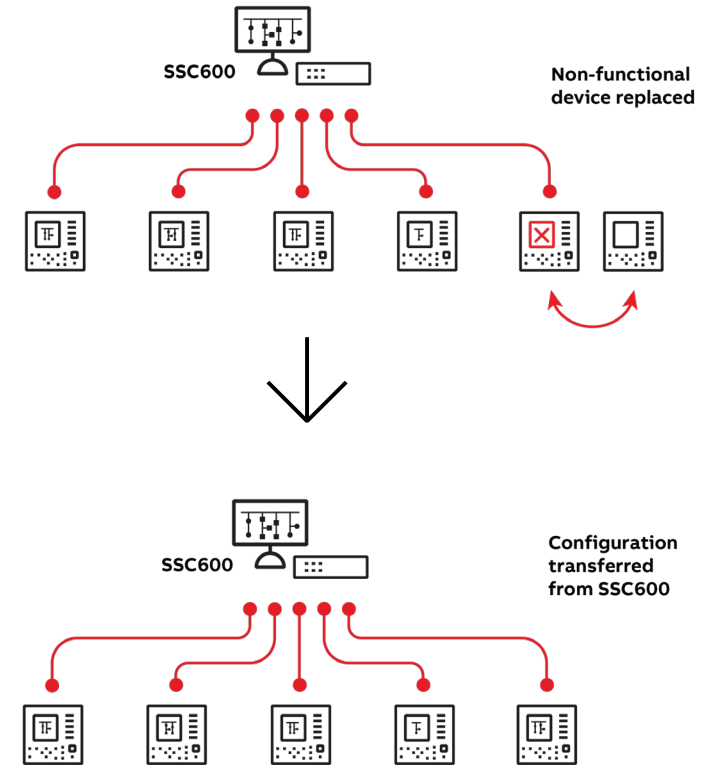
### Solution

Protection relay and/or MU configurations always stored in SSC600

Backups

- Quick replacement of relay and/or SMU615
- New and replacement units plugged-in and configuration downloaded
- Quick system restoration with minimum downtime per configuration

Secure upload of SSC600 configuration backups to on-premise cloud or remote cloud to facilitate fleet management on-site or across multiple sites, remote upgrades and remote supervision



# Centralized protection and control features

## Simplification of assets



### Customer need

Minimize the number of devices in the network for reduced network complexity

Simplify spare device management

Concentrate on 1-2 devices that fit all applications



### Solution

615/620 series devices as universal devices with basic backup functions

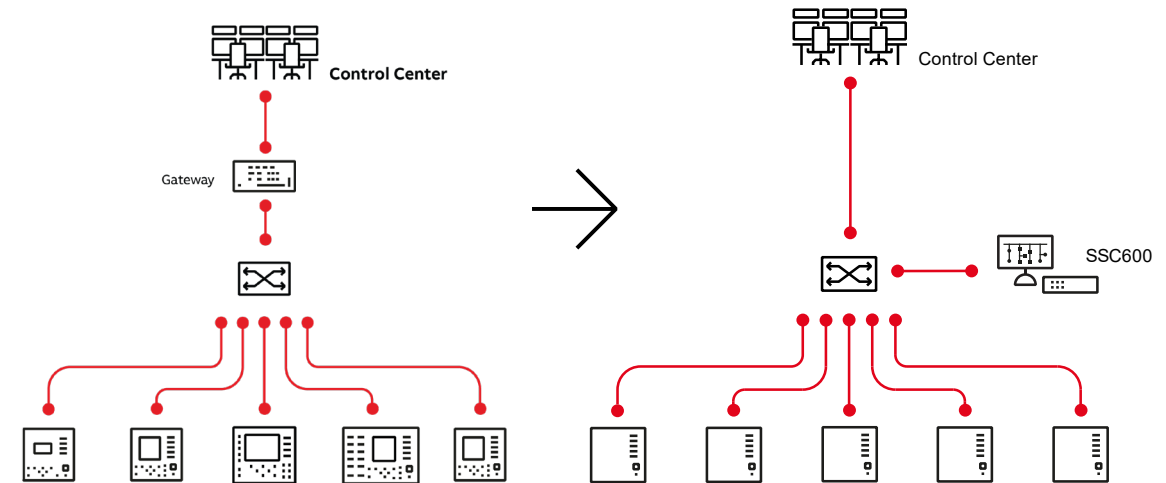
SSC600 as main protection with flexible high-end protection functionality

Reuse of templates with small changes to the main configuration for different substations

No need for additional gateway as IEC 60870-5-104 allows easy and direct connection to an upper-level system such as SCADA

Number of protection device variants reduced when using:

- SSC600 (one variant)
- SMU615 (one variant)



# Centralized protection and control features

## Protection and control virtualization



### Customer need

Easy-to-use interface without using the relay setting and configuration tool, PCM600

Embedded local HMI (LHMI) functionalities



### Solution

Smart Substation Control and Protection SSC600 SW

- Use hardware of your choice
- Introduce new functionalities via adding software only
- Gain virtual machine technology benefits
- Get access to the latest features and functionalities with Software Maintenance Agreement (SMA)



**2** software images on one server



**2** centralized protection and control devices



**60** protection relays

# Centralized protection and control features

## Simplified project and engineering workflow



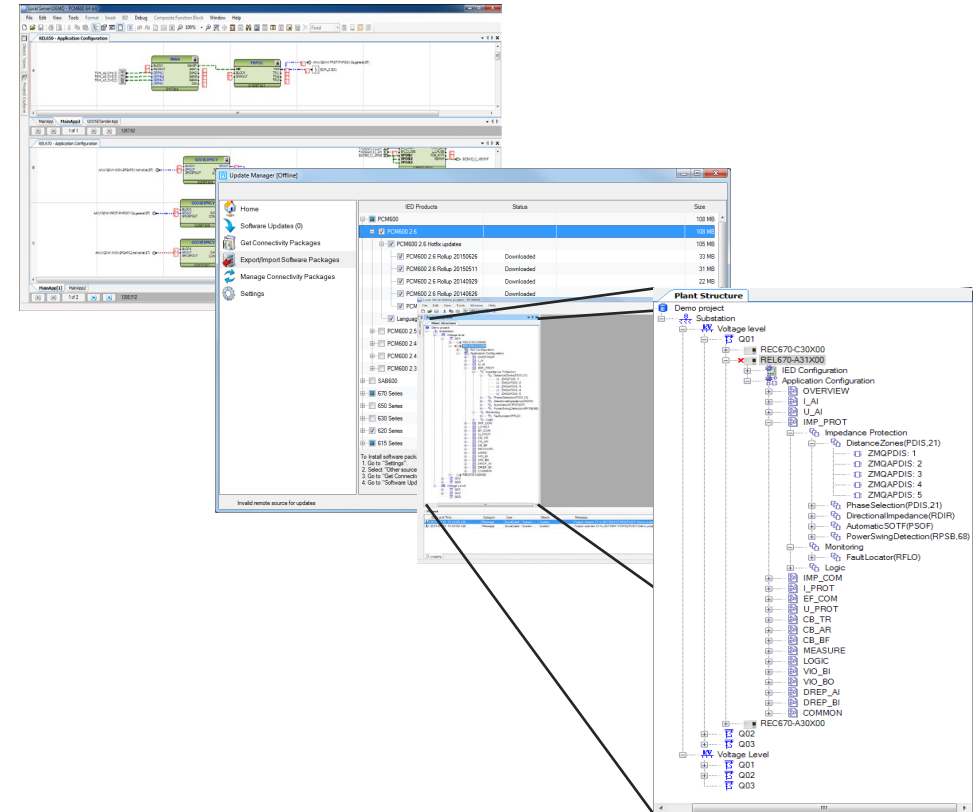
### Customer need

Save time and money on system engineering  
Concentrate all engineering efforts on one product



### Solution

PCM600 used for configuration, engineering and setting of SSC600  
Simplified workflow for bay-level protection and control functionality  
Reuse of templates with small changes to the main configuration for different substations



# Centralized protection and control features

## Interoperability



### Customer need

Future-proof communication inside the substation

Possibility to take advantage of features from the latest international standards

Seamless integration of all IEC 61850-compliant devices in the substation

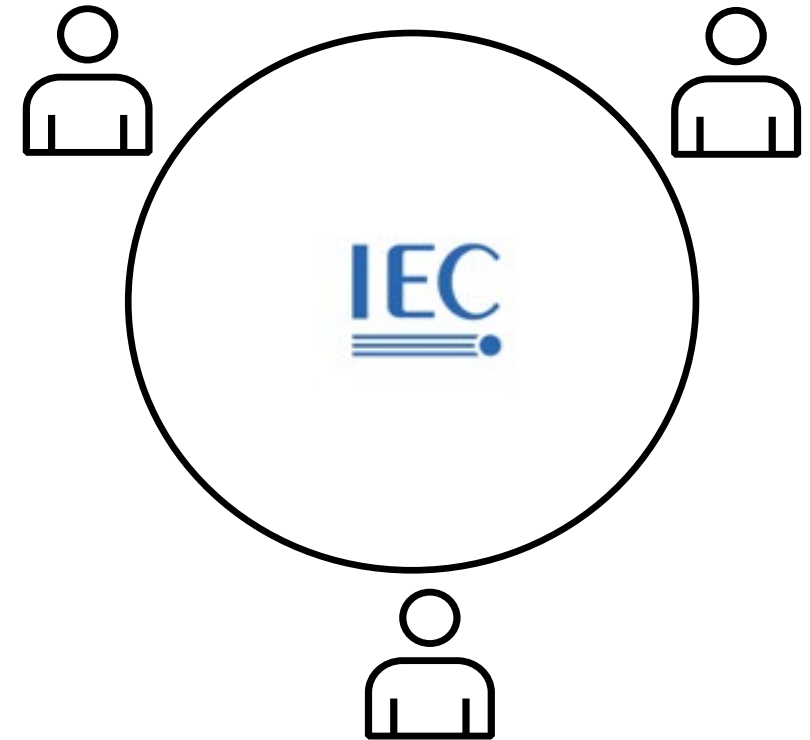


### Solution

SSC600 is based on international standards:

- IEC 61850-7 for modelling
- IEC 61850-8-1 (GOOSE and MMS) for control and reporting
- IEC 61850-9-2LE (SMV) for measurements
- IEEE 1588 v2 (Precision Time Protocol) for time synchronization
- IEC 61850-90-5 R-GOOSE for substation-to-substation communication
- COMTRADE for fault analysis

MUs and remote I/O units can be any standard-compliant devices, even non-ABB products.





# Centralized protection and control features

## Support for digital substations



### Customer need

Distribution applications with flexible multiapplication functionalities

Reduced hardwiring

Digital communication between substations with routable GOOSE (R-GOOSE)



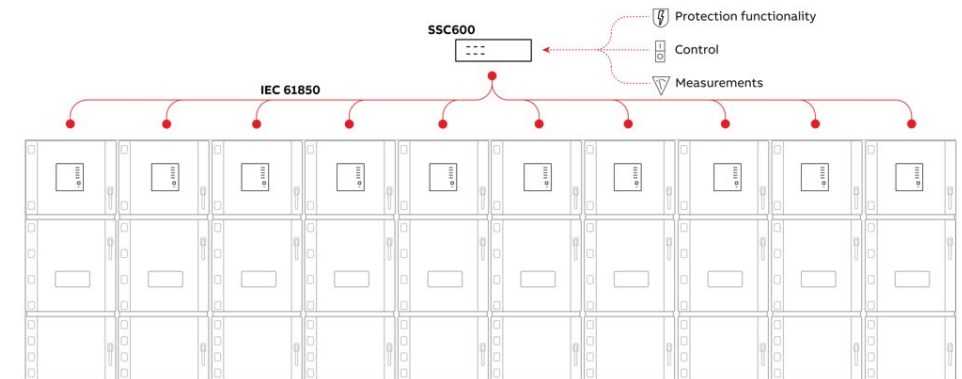
### Solution

Existing IEC 61850 devices with IEC 61850-9-2 sending capabilities

Support for ABB sensor technology with the Relion family of protection and control devices

REX640 can be used in applications where SSC600 is not applicable

SSC600 and its application coverage is not dependent on the voltage level



# Centralized protection and control features

## Simplified busbar protection



### Customer need

- Cost-efficient protection for busbar(s)
- Different choices for implementation of busbar protection
- Busbar protection without additional hardware



### Solution

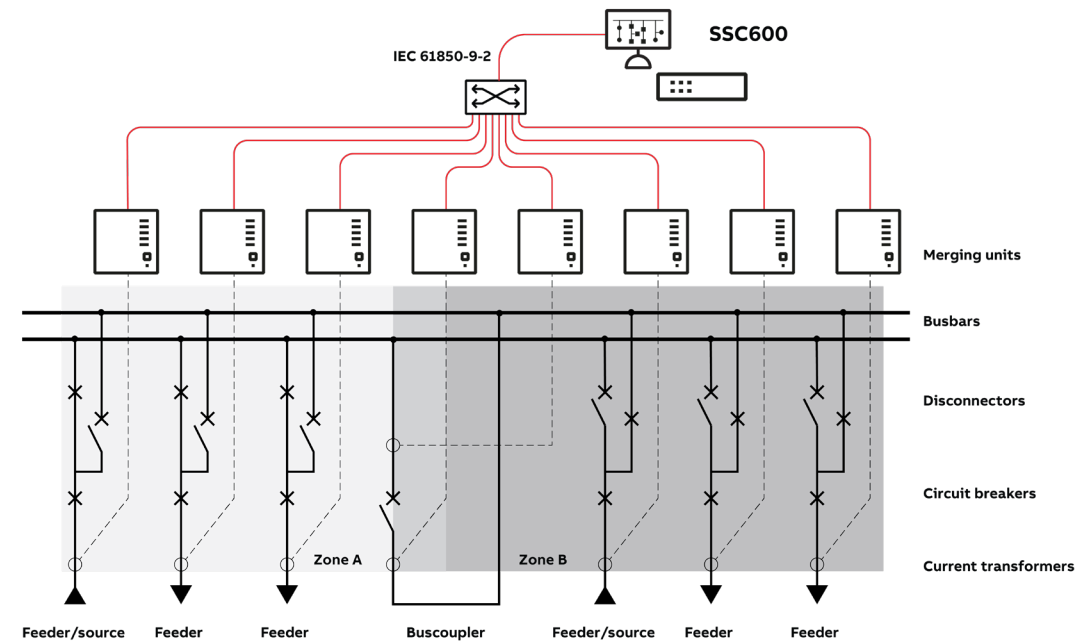
#### Arc flash protection

- MUs sense the light whereas SSC600 has the logic for selective tripping
- Easy-to-manage and engineer system with multiple sensors

#### Busbar differential protection

- Based on the low-impedance differential principle
- No need for extra equipment in addition to SSC600 and MUs
- Up to 30 bays
- 4 protection zones and a check zone
- For single and double busbars

On top of other substation protection, SSC600 can be used for busbar protection



# Centralized protection and control features

## Cyber security



### Customer need

- Enhanced cyber security
- Defense in depth with segregated networks
- Secure firmware updates



### Solution

- Support for the evolving cyber security standards and regulations for critical infrastructure
- Support for separating the IEC 61850-9-2LE process bus to a separate network interface
- Separate local interface for SLD control, engineering interface with DHCP and service interface with own IP address
- Closable network-capable ports
- Secure engineering communication with HTTPS and FTPS
- Rollback to previous version in case of firmware update error

SSC600 - Parameter Setting					
Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
✓ Communication: 0					
✓ Configuration					
✓ Rear port(s)					
✓ IP address	🔒	192.168.3.100			
✓ Subnet mask	🔒	255.255.255.0			
✓ Default gateway	🔒	192.168.2.1			
✓ Mac address	🔒	XX-XX-XX-XX-XX-XX			18 characters
✓ Local port					
✓ IP address	🔒	192.168.0.254			
✓ Mac address	🔒	XX-XX-XX-XX-XX-XX			18 characters
✓ Remote port					
✓ Enable	🔒	False			
✓ IP address	🔒	192.168.1.254			
✓ Mac address	🔒	XX-XX-XX-XX-XX-XX			18 characters
✓ Service port					
✓ Enable	🔒	False			
✓ IP address	🔒	192.168.3.10			16 characters
✓ Subnet mask	🔒	255.255.255.0			16 characters
✓ Mac address	🔒	XX-XX-XX-XX-XX-XX			18 characters

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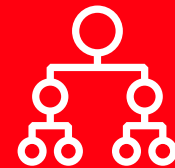
**Introduction**



**Centralized protection and control features**



**Customer benefits**



**Solution examples**

# Centralized protection and control features

## Redundancy of protection functionality via a hybrid installation



### Customer need

Redundancy of protection and control functionality  
Selective and reliable backup protection



### Solution

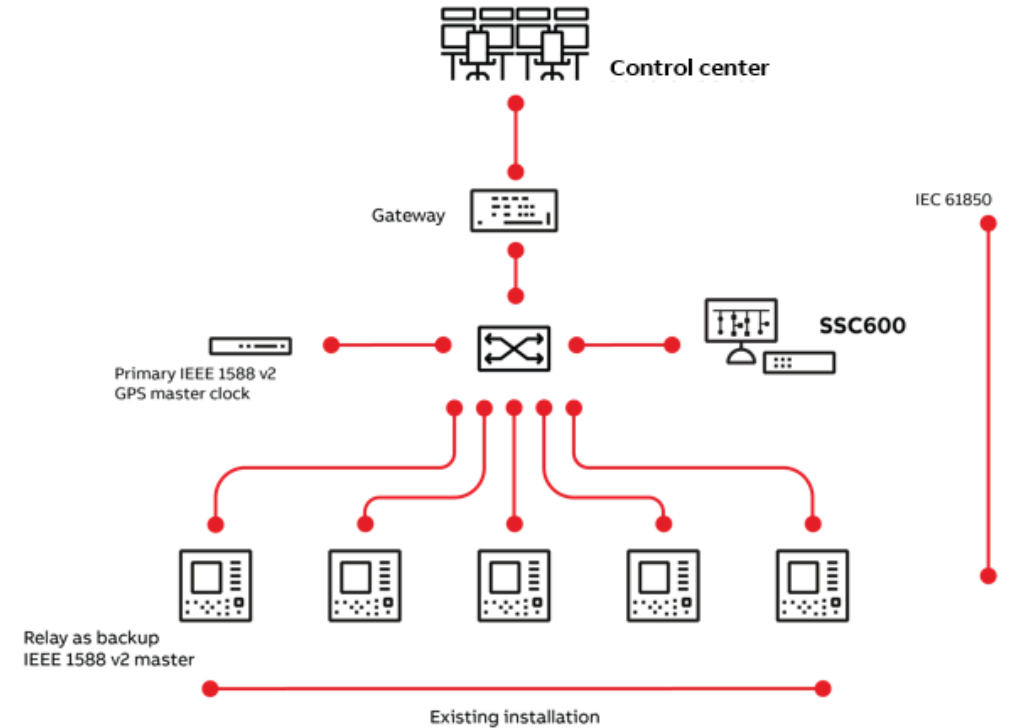
SSC600 added to existing installation as main protection, leaving existing relays and other protection devices as backup protection

Redundant communication with PRP Time synchronization via the IEEE 1588 v2 GPS master or a relay acting as backup time master

Substation gateway doubles up as HMI

Combined or separated IEC 61850 network for the process and station bus

Direct communication to the control center possible with IEC 61850 or IEC 60870-5-104, without an external gateway in between



# Centralized protection and control features

## Centralized protection and control with full redundancy



### Customer need

Change to centralized protection with a redundant protection scheme

Complete greenfield or retrofit installation



### Solution

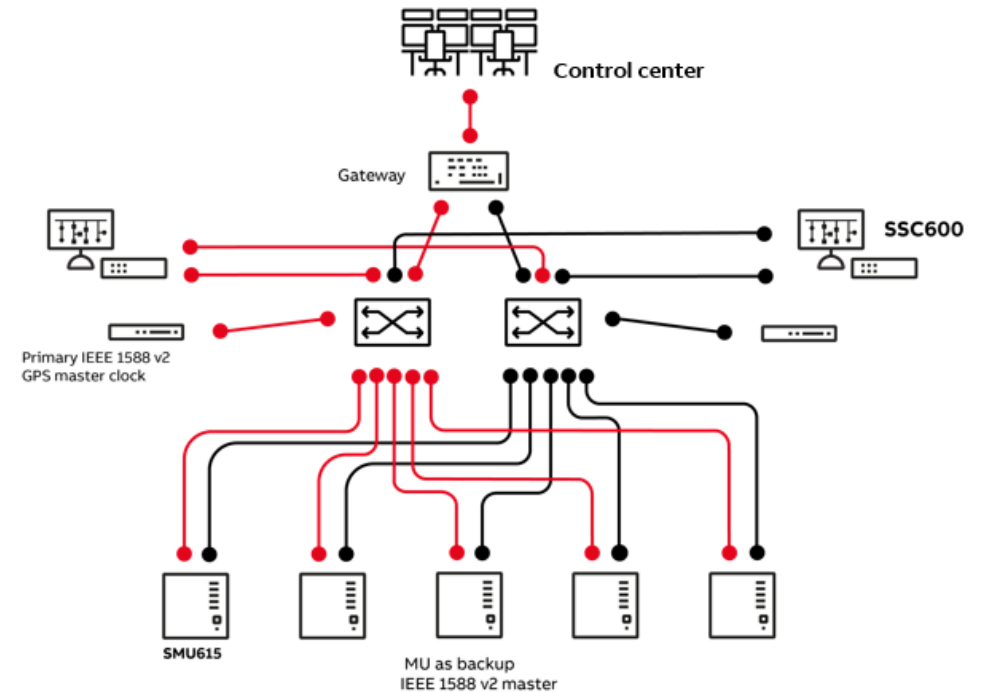
Two SSC600 devices and one gateway to the SCADA system

- Redundant power supply in SSC600
- Both SSC600 devices in hot-hot redundancy mode
- Redundant communication with PRP
- Time synchronization via the IEEE 1588 v2 GPS master and backup time master from MU or secondary GPS master

Substation gateway doubles up as HMI

Combined or separated IEC 61850 network for the process and station bus

Direct communication to the control center possible with IEC 61850 or IEC 60870-5-104, without an external gateway in between



# Centralized protection and control features

## Centralized protection with backup trip unit



### Customer need

Failsafe redundant backup trip signal in case of relay or MU failure



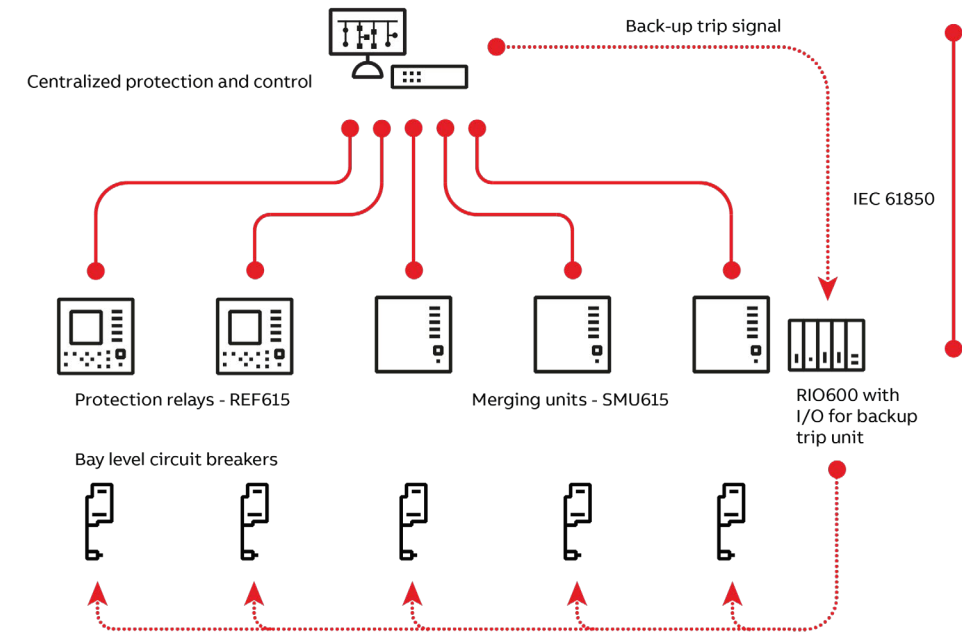
### Solution

SSC600 combined with IEC 61850-capable devices with IEC 61850-9-2LE sending capabilities

SSC600 as main protection with flexible applications

SMU615 or basic REF615 feeder protection relay as backup protection

Remote I/O unit RIO600 added to facilitate backup trip signaling to bay-level circuit breakers



**ABB**