ABB OY DISTRIBUTION SOLUTIONS

Smart substation control and protection SSC600

Product presentation

1MRS758993 B

Smart substation control and protection SSC600

Contents

 * *(full summary in Speaker's notes)*

Product introduction

Smart substation control and protection SSC600

Centralized Protection and Control for Distribution Substations

Centralized protection and control concept

Why Centralized Protection and Control?

Product lifecycle difference of existing primary equipment and secondary technology

Shortage of experienced personnel to manage increasingly complex secondary installations

Renewables and **distributed generation**

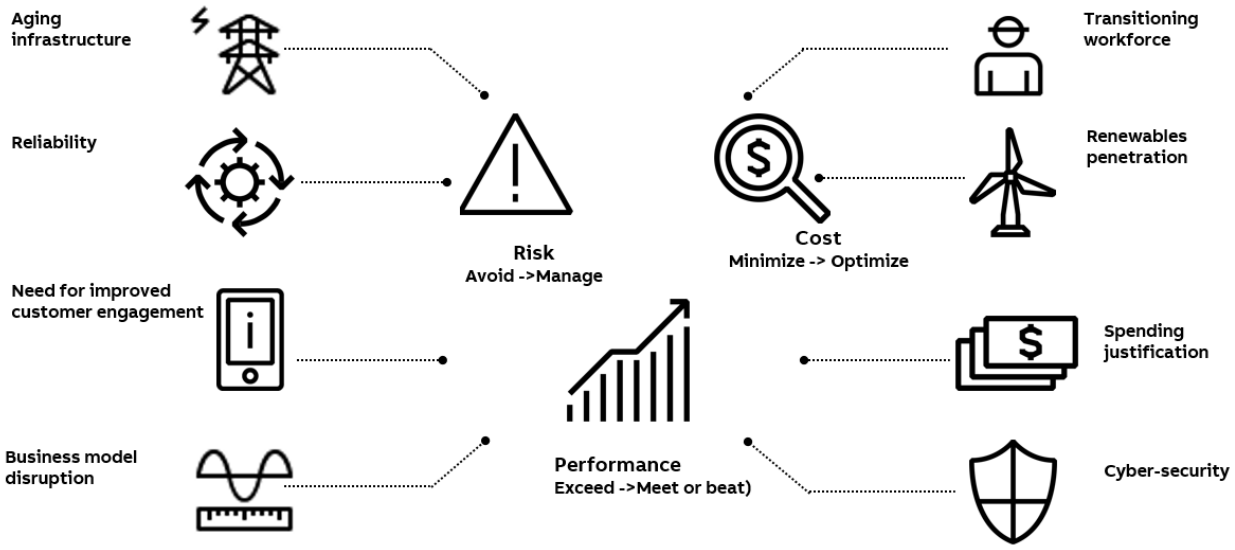
- Bi-directional power flow, meshed-network
- Requires new or advanced functions/applications

Need to automate with **smaller investment**

- Quicker deployment
- Easier (inexpensive) extensibility, upgrades, life cycle support
- High levels of flexibility, reliability, availability, safety

Standardized solutions based on IEC 61850

- Simple and future proof interface between primary and secondary equipment
- New solutions to handle existing installed base and multi-vendor environment/interoperability



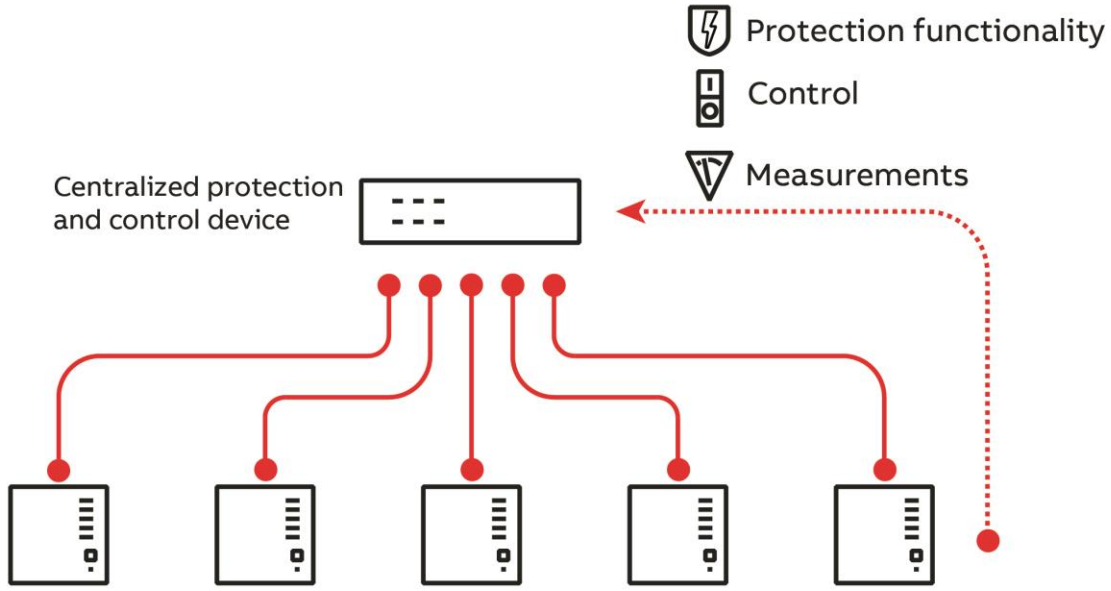
Smart substation control and protection SSC600

What does it mean – ”centralized”- protection?

Centralized protection and control device offers:

- Protection and control functionality centralized in one device in the substation
- The ability to view and monitor processes on substation level
- Centralized access to control and monitoring functionality via a single human-machine interface (HMI)
- Customization and flexibility with a set of base functionality and optional application packages
- A wide range of functionality from several software packages can be combined to meet specific power system protection requirements
- Coverage of a wide range of utility and industrial applications
- Testing and commissioning is similar to a standard solution, current and voltage signals can be injected to each SMU or Relion relay acting as a merging unit.

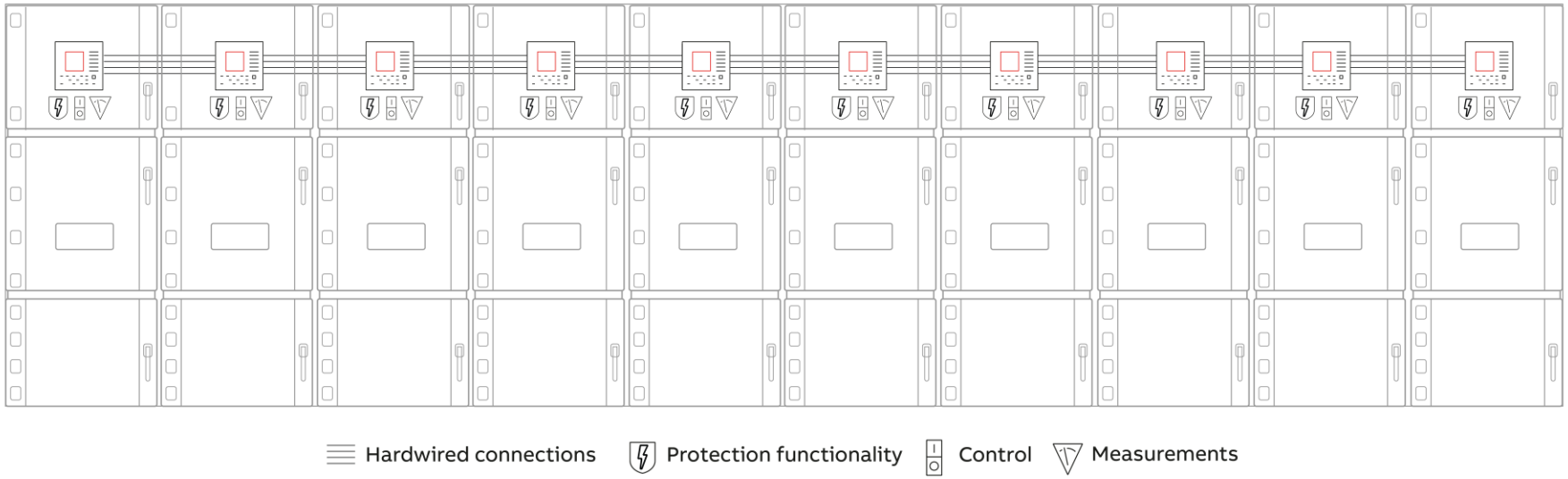
- **SSC600 offers extended capabilities** by incorporating merging units and Relion protection and control devices to form a custom protection and control solution.



Smart substation control and protection SSC600

A brand new way of thinking of protection and control in distribution networks

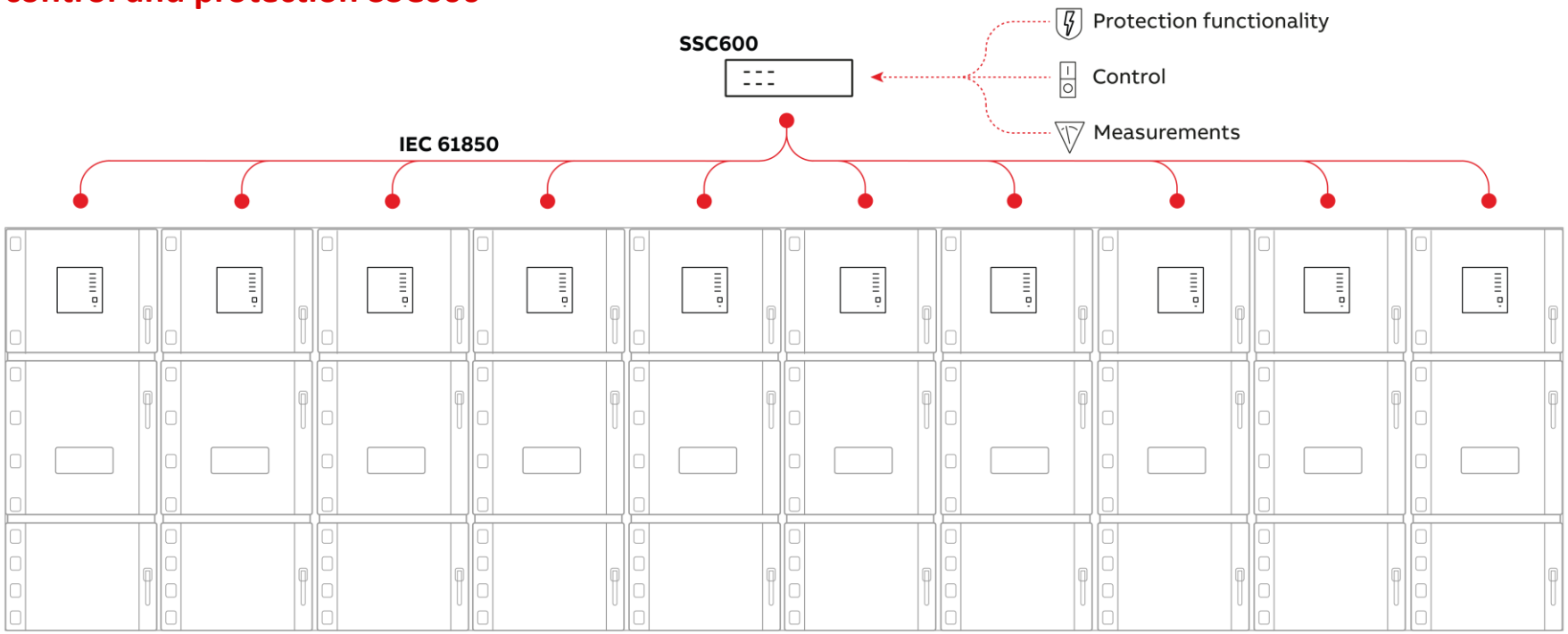
Traditional substation protection, control and measurement



Smart substation control and protection SSC600

A brand new way of thinking of protection and control in distribution networks

Smart substation control and protection SSC600



Smart substation control and protection SSC600

A brand new way of thinking of protection and control in distribution networks

Smart substation control and protection SSC600

- ABB Ability™ smart substation control and protection for electrical systems, 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 life-cycle
- With software based on existing **Relion technology** it is designed for **a wide range of power distribution protection applications** – from basic feeder protection and control to complex multi-bay substation applications.
- It delivers the **flexibility to adapt and modify to changing network requirements** when combined with Relion protection and control devices
- Enables **visibility to view and monitor 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)

Smart substation control and protection solution

A brand new way of thinking of protection and control in distribution networks

Substation merging unit SMU615

- One **single unit for all measurements and I/O for single bay**, uses standard wiring and design on bay level
- Supports **both conventional CT&VT and sensor technology**
  - 4I + 3U (Io 0,2/1A)
  - 3Is + 3Us + Io (Io 0.2/1A)
- **Compact and reliable**
- IP54 on front side, IP20 on read side and connections
- 8BI + 6BO + 3HSO
- Optional arc flash detection

Customer values

Smart substation control and protection SSC600

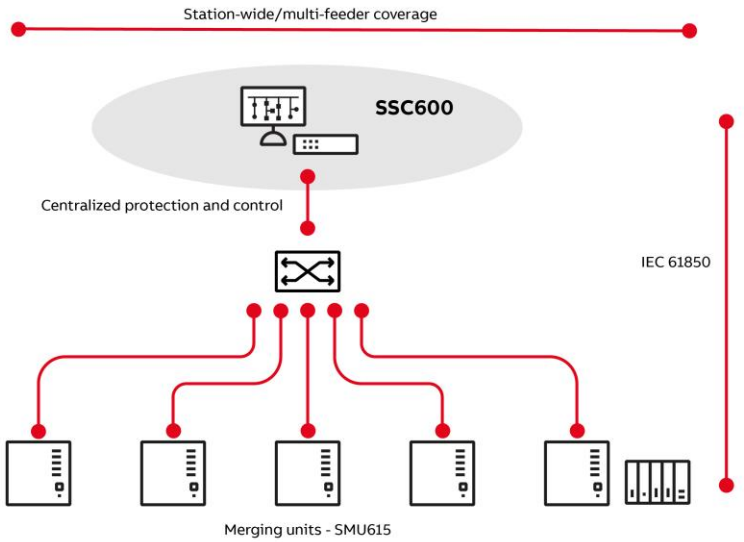
Smart substation control and protection SSC600

Customer values

Innovative application and design

SSC600 offers:

- A new way of protection and control – incorporating the concept of centralized protection and control.
- **New and existing industry leading products and functionality enabled** across a wider field of application, like ABB Ability solutions for power distribution networks, as well as other related solutions like digital substations, predictive maintenance, etc.
- All needed protection and control functionality is combined into this solution for **wide application coverage.**
- New business model introduces **continuous support and digital services** that add value to the entire life-cycle of the substation.



Innovative application and design, supporting not only the evolving power networks, but also the way we support customers

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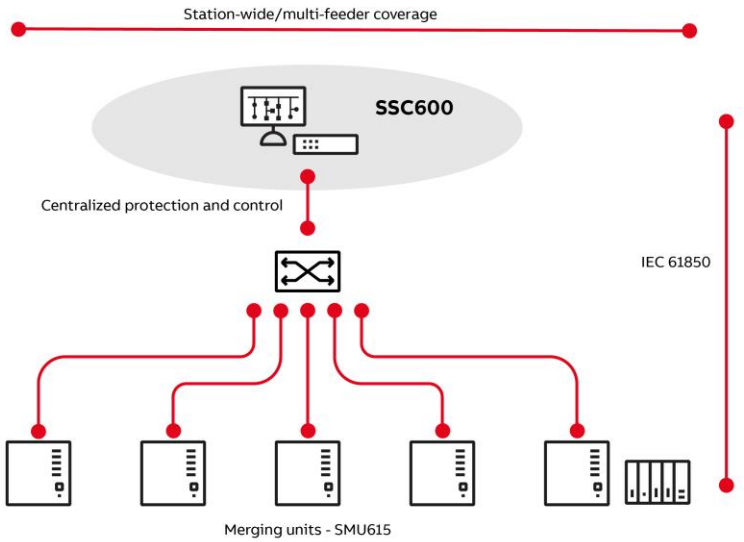
Customer values

Unmatched flexibility

SSC600 offers:

- **The protection functionality in the centralized solution** that provides flexibility to build a optimal power distribution protection scheme and thus reducing complexity
- The **flexibility and freedom to**
  - **adapt to changing network environments, or**
  - **extend the solution at any time with minimised engineering, or**
  - **extend the life-cycle of the installation by updating and adding functionality** to the existing protection scheme
- Minimised process downtime during maintenance work due to the **ease of device replacement** and minimised engineering of the solution



Unmatched flexibility help customers stay ahead of the drastically evolving power network environments

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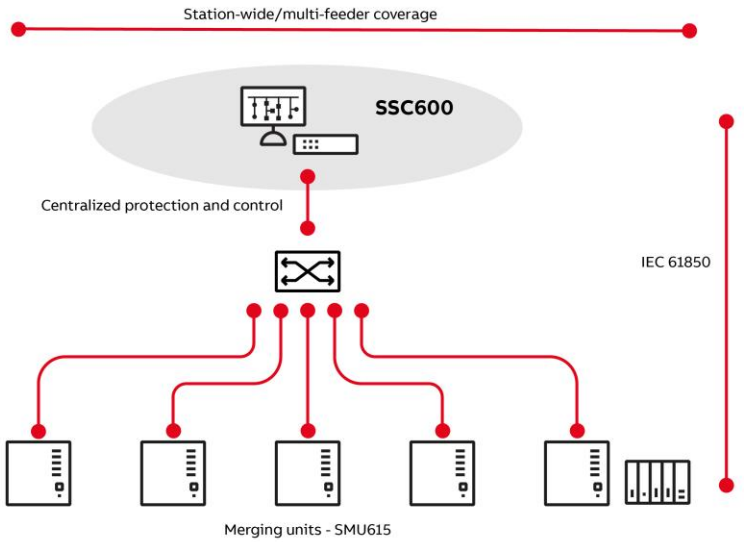
Customer values

Long awaited ease of use

- The solution paves the way for **minimized process downtime via visibility** created with ABB Ability and substation level processes for
  - **better visibility of substation processes** as data is condensed at substation level by the centralized protection and control, processed and provided to even higher level processes (ABB Ability)
  - **reduced complexity of the network** due to all protection and control functionality in one centralized device in the substation
  - **more effective and efficient process management** because of the increased process visibility at substation level and higher levels with ABB Ability
- **Ease of device addition or replacement with minimised engineering** of the solution



Long awaited ease of use supporting customers to make sense of complexities in evolving distribution networks

Application coverage

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Smart substation control and protection SSC600

Application coverage overview

SSC600 comes with a variety of convenient, ready-made application packages which can be combined flexibly to meet application-specific requirements.

The available packages support the following applications:

Base protection functionality

- Overcurrent
- Earth fault
- Fault recorder
- Switchgear control
- Voltage
- Frequency

Power transformer protection

- Protection for two winding power transformers

Machine protection

- Protection of asynchronous motors

Power quality measurements

- Current and voltage distortions
- Voltage variation
- Voltage unbalance

Feeder/line protection

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

Interconnection protection

- Protection of interconnection points of distributed generation units

On-load tap changer control

- Position indication
- Voltage regulation

Busbar protection

- Protection against arc flash
- Low impedance based busbar differential

* Included as standard (always included)

Protection and control application packages

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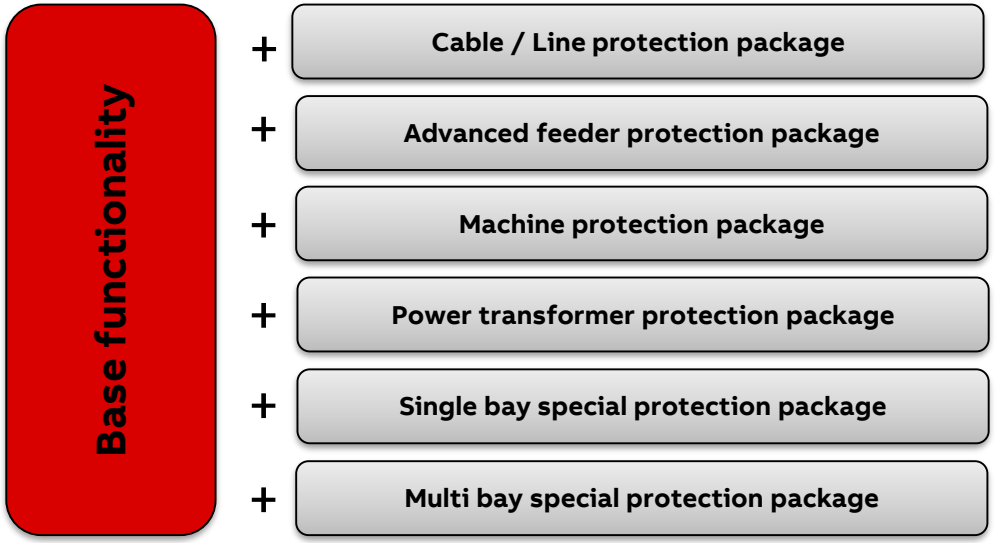
Application packages

Overview

– Functionality is divided into:
  - **Comprehensive base functionality** included as standard (always included)
  - **6 application packages (optional)** – can be freely selected as required by the intended application – none, some or all

Note! The software options can customized, modified and also added later on, even at site after installation



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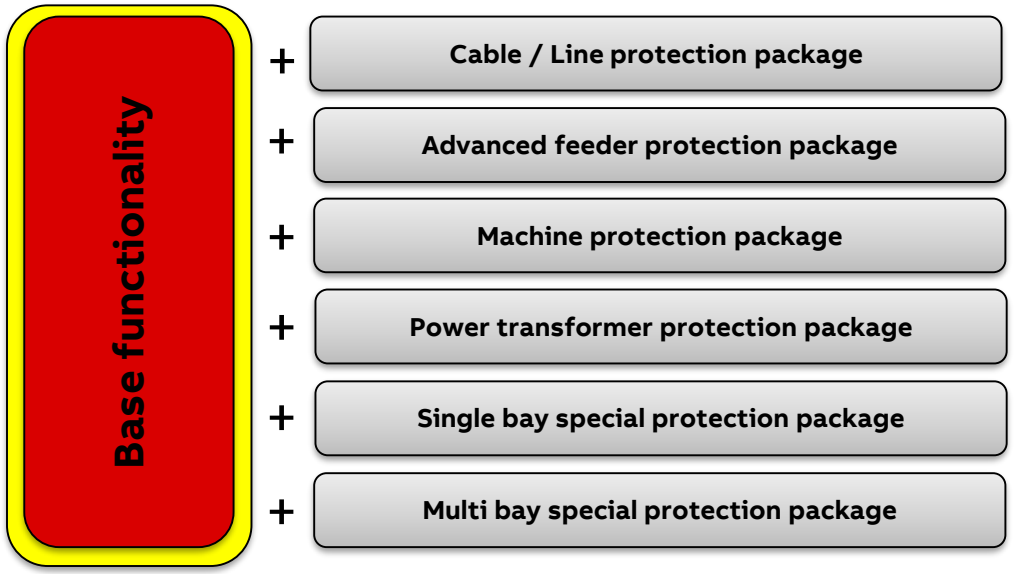
Application packages

Base functionality

The base functionality is always included and contains

- **All basic functionality**
  - Basic overcurrent and earth-fault protection always included
  - Extensive logical programming function library
  - Control
  - Condition monitoring
  - Measurements
  - Logging (disturbance recorder & fault recorder)
- **All supervision and measurement functions**



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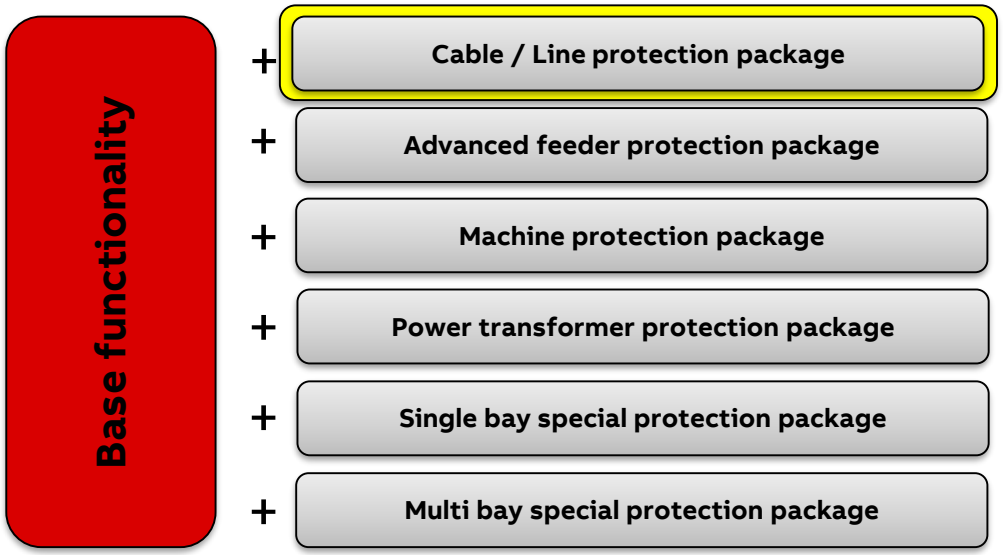
Application packages

Cable / Line protection package

Functionality includes

- Three-phase directional overcurrent protection, low stage
- Three-phase directional overcurrent protection, high stage
- Directional earth-fault protection, high stage
- Three-phase directional overpower (reverse power) protection
- Phase discontinuity protection
- Three-phase thermal protection for feeders, cables and distribution transformers
- Auto-reclosing
- Synchronism and energizing check



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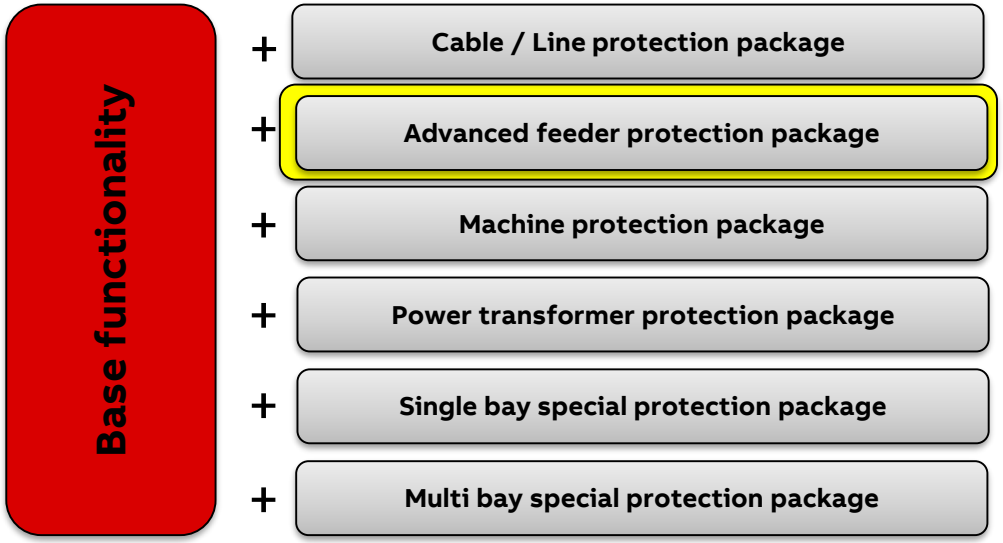
Application packages

Advanced feeder protection package

Functionality includes

- Admittance based earth-fault protection
- Multi-frequency admittance-based earth-fault protection
- Wattmetric based earth-fault protection
- Transient / intermittent earth-fault protection
- Fault locator
- Directional reactive power under voltage protection
- Low voltage ride through protection



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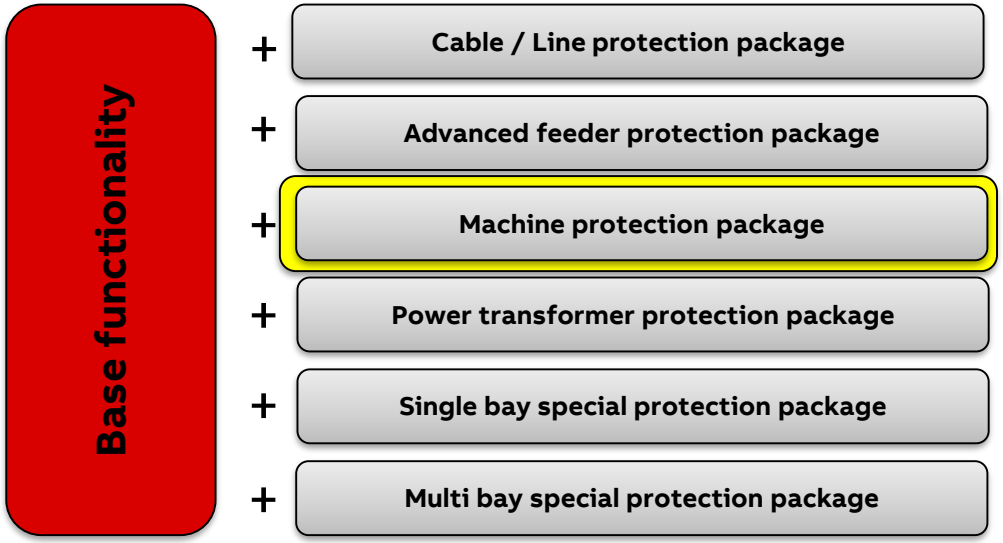
Application packages

Machine protection package

Functionality includes

- Negative-sequence overcurrent protection for motors
- Loss of load supervision
- Motor load jam protection
- Motor start-up supervision
- Phase reversal protection
- Thermal overload protection for motors
- Emergency start-up



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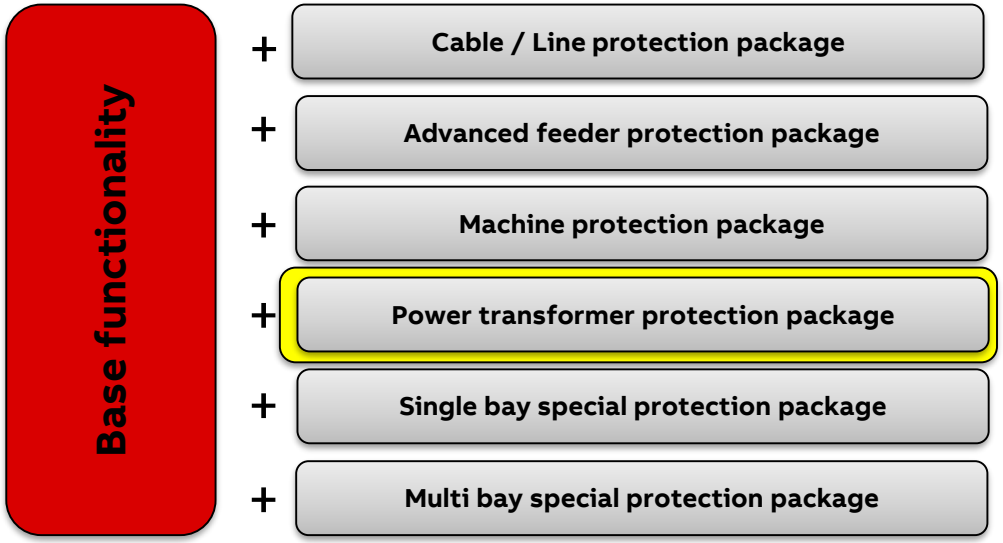
Application packages

Power transformer protection package

Functionality includes

- Three-phase thermal overload protection for power transformers, two time constants
- Stabilized and instantaneous differential protection for 2-winding transformers
- Numerical stabilized low impedance restricted earth-fault protection
- Three-phase underimpedance protection
- Tap changer position indication



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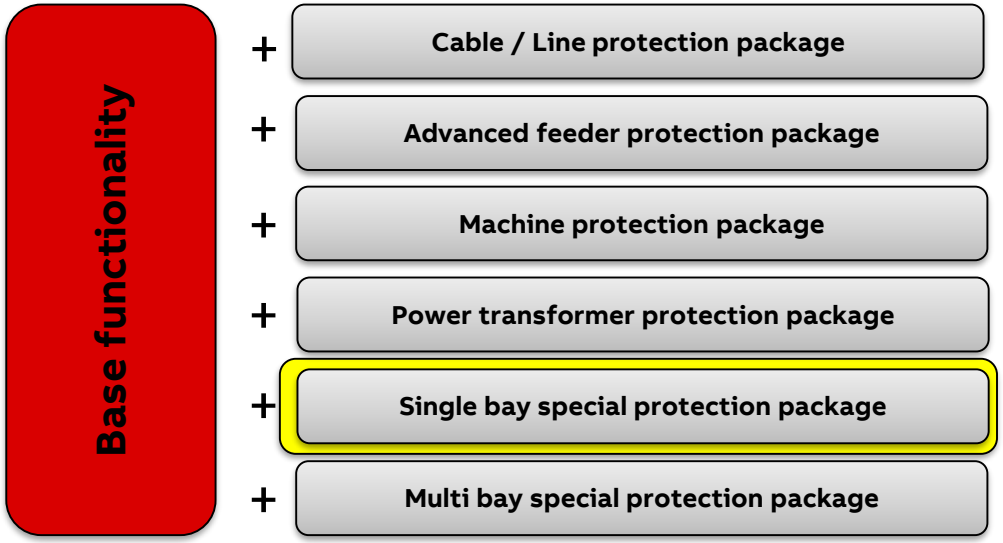
Application packages

Single bay special protection package

Functionality includes

- Distance protection
- Tap changer indication and control with voltage regulator
- Power Quality
- Current total demand and harmonic distortion (TDD and THD)
- Voltage total harmonic distortion (THD)
- Voltage variation
- Voltage unbalance



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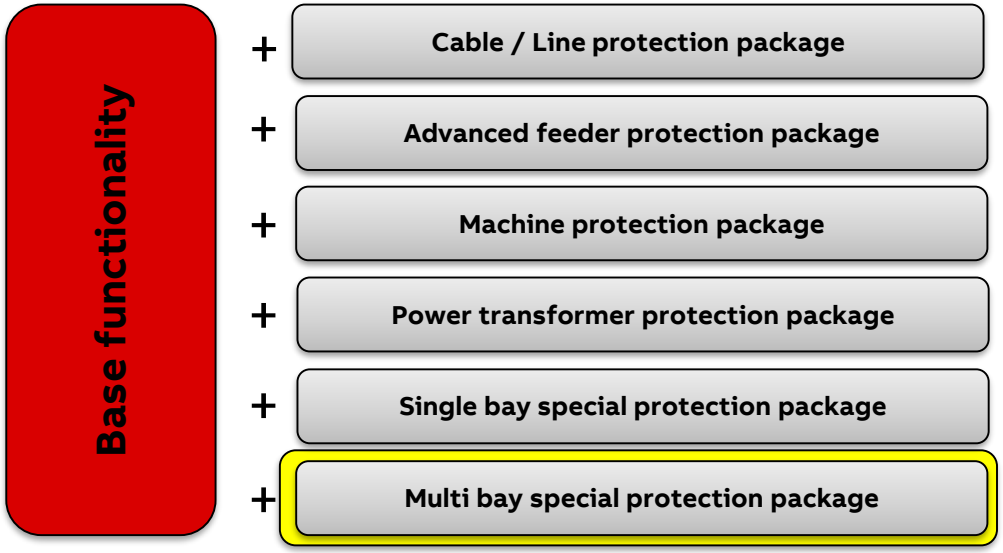
Application packages

Multi bay special protection package

Functionality includes

- Load shedding and restoration across 4 bus sections
- Arc flash protection
- Busbar differential protection



Software and hardware modularity

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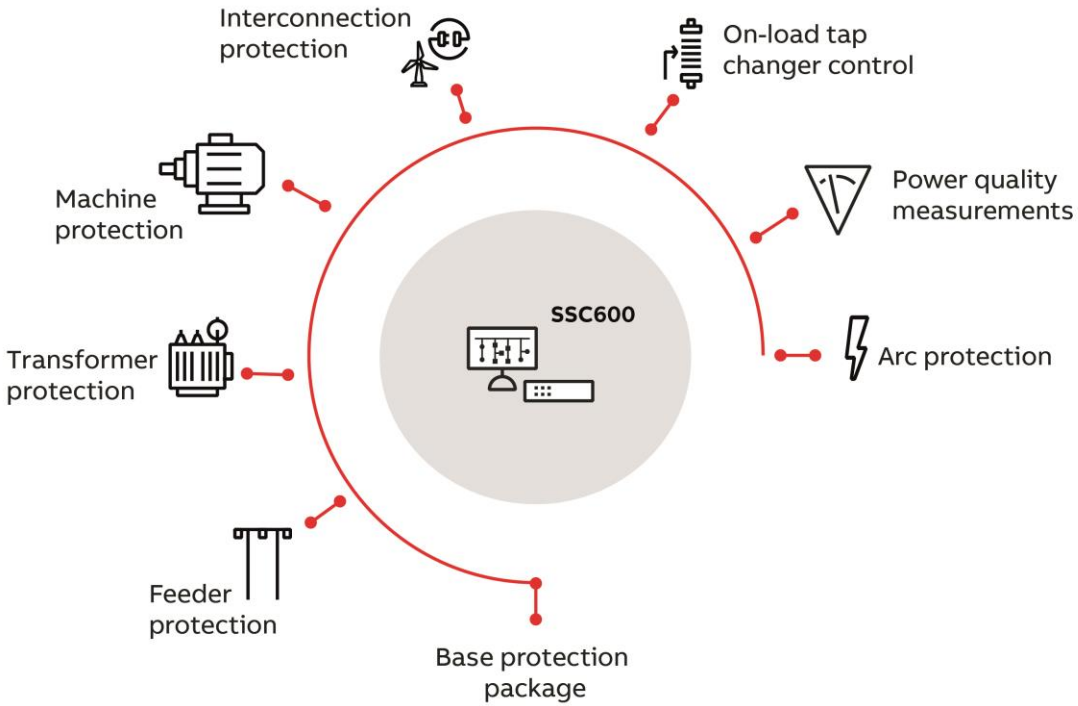
Smart substation control and protection SSC600

Software and hardware modularity

Freedom of modification

SSC600 offers:

- **Modular software** that allows you to create your own, unique solution for your specific protection requirements.
- A **customer oriented license-based modification concept** for adding software and/or hardware according to user needs when requirements may change.
- **Continuous and easy access to new software development** to support the upgrading or modification of the entire substation system at any time during its lifecycle for optimal asset utilization
- Support for modification to be done: at site - by end-users - without network or cloud access
- The new centralized approach with the advantage of only having to engineer or modify one device instead of all bay-level protection and control devices.



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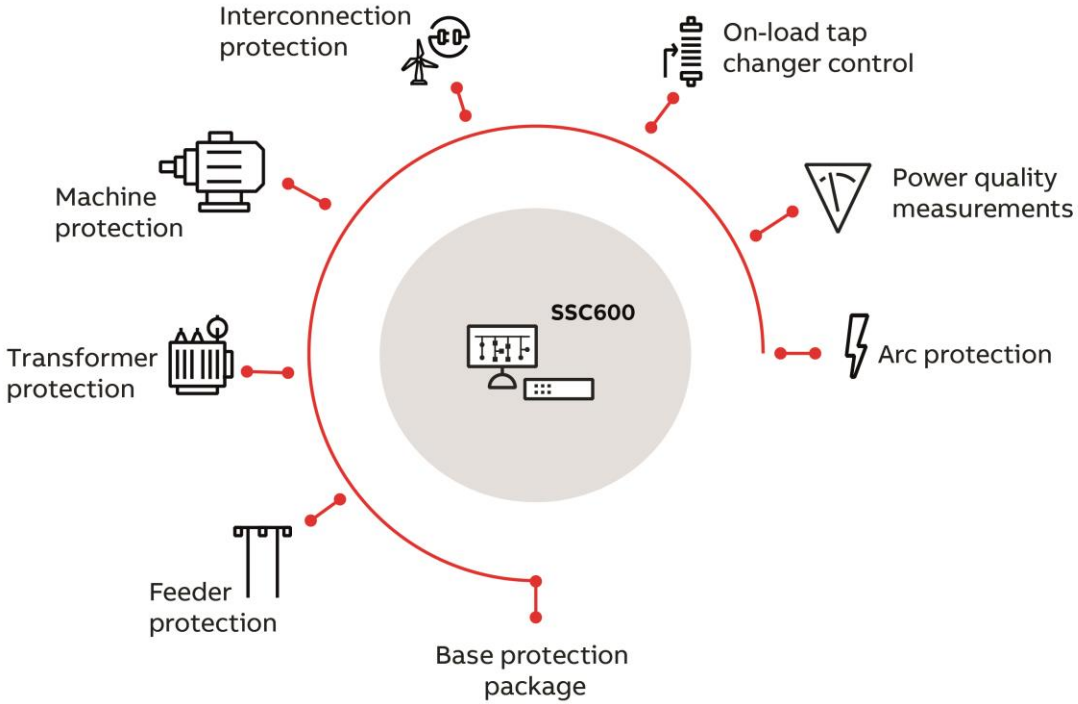
Software and hardware modularity

Hardware options

SSC600 offers:

- The same hardware for all available applications
- Ony two needed ordering options
  - Power supply (high/low voltage)
  - Optional SFP communication module



Human machine interface (HMI)

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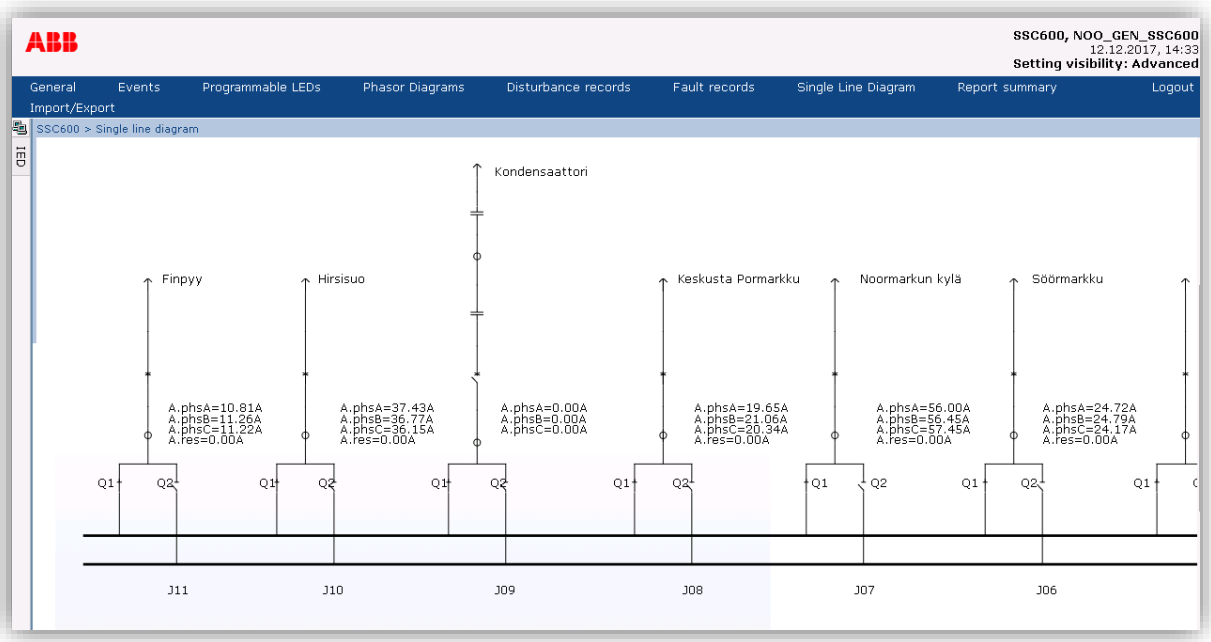
Smart substation control and protection SSC600

Human machine interface (HMI)

Easy operation via WebHMI

SSC600 offers:

- Clear and sharp visualization of single line diagrams and new power distribution process information
- Control and monitoring – all in one page for increased situational awareness and ease of use
- Local or remote location of the HMI enabled



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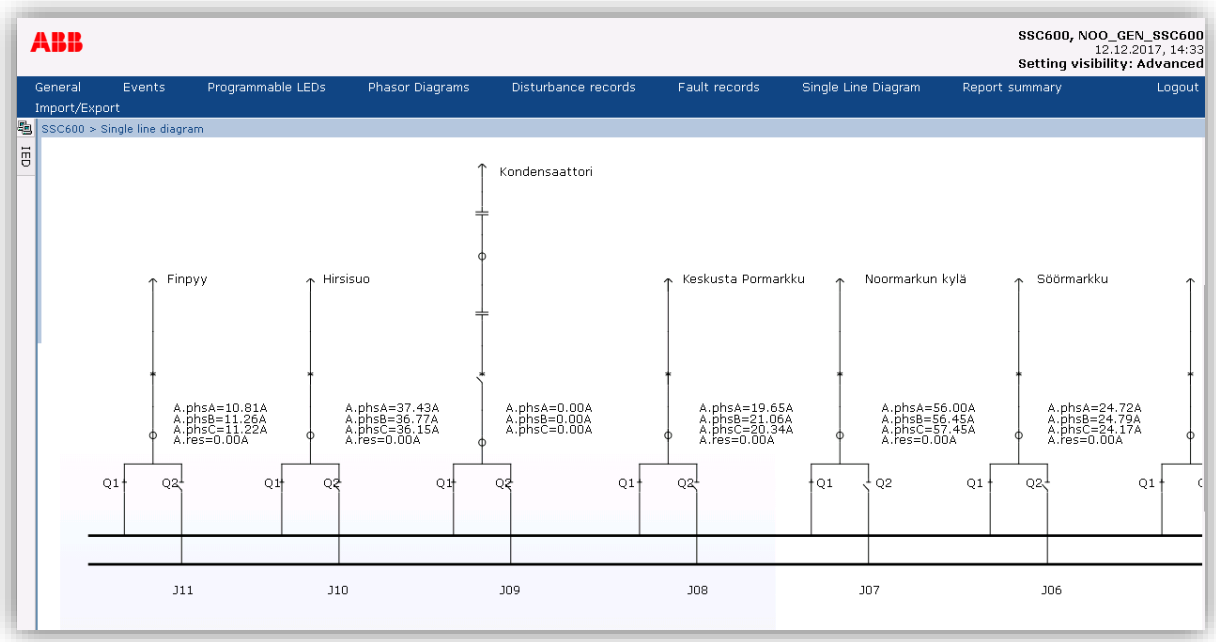
Web-based Human machine interface (WHMI) – easy operation for the whole substation

Substation level Single Line Diagram (SLD)

SSC600 offers:

- Visibility and control of the whole substation via the SLD
- Secure management of control access
  - Control is only allowed from dedicated local interfaces,
  - From other interfaces only monitoring is allowed



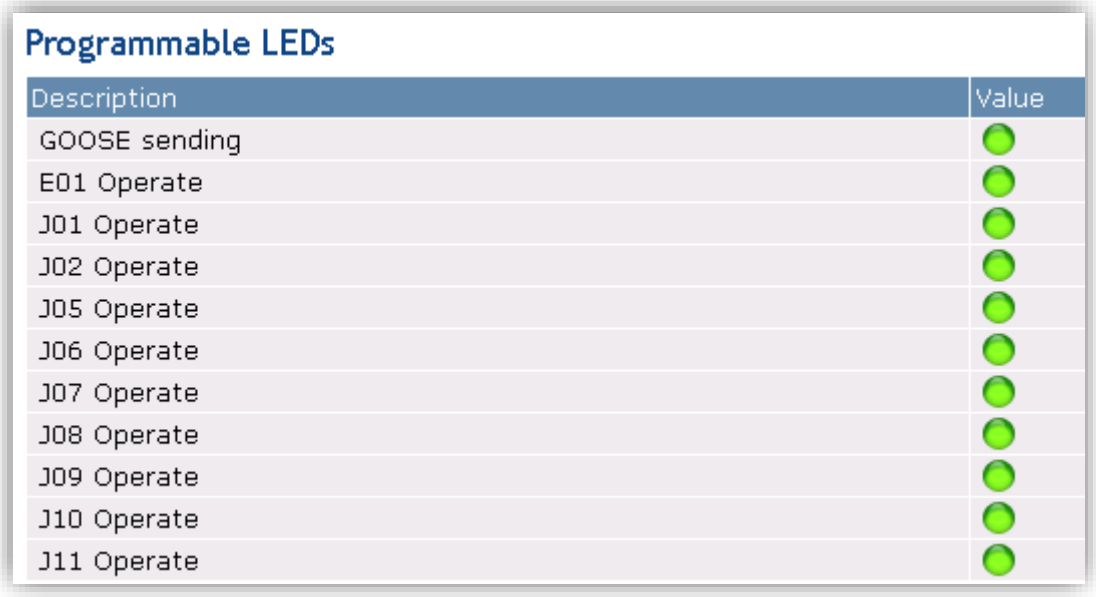
Smart substation control and protection SSC600

Web-based Human machine interface (WHMI) – easy operation for the whole substation

Substation level alarm handling

SSC600 offers:

- Up to 99 virtual alarm LEDs for all kinds of subsation level alarms
- Centralized alarm center for the substation



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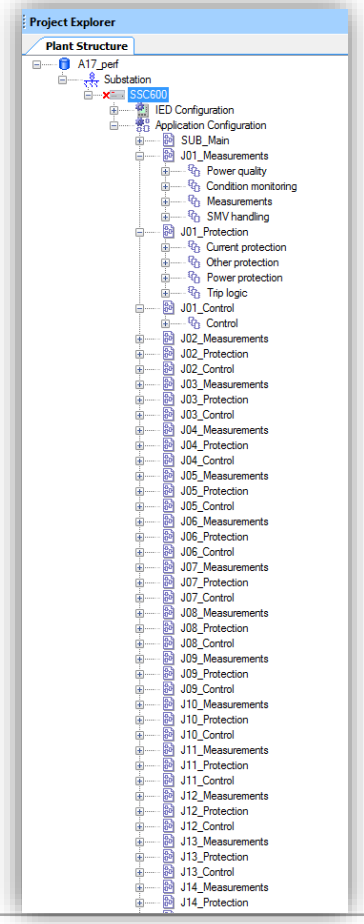
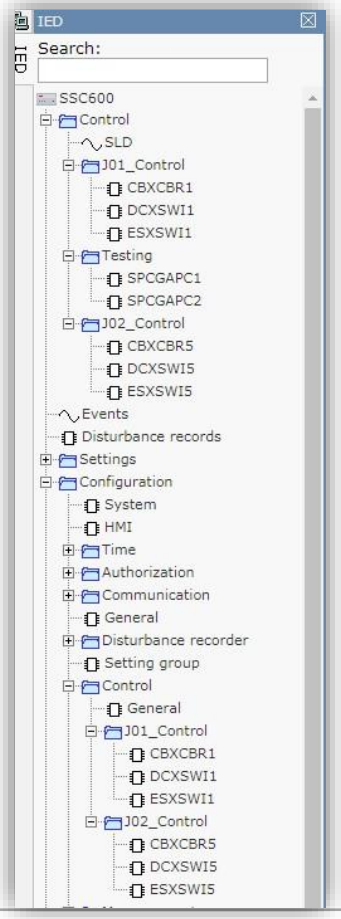
Web-based Human machine interface (WHMI) – easy operation for the whole substation

Settings management in WHMI, grouping of functions

SSC600 offers:

- Clear categorization of settings based on application needs
  - Easy to manage bay-specific settings from the WHMI
- Synchronization with the application categorization done in the engineering phase with PCM600
- Grouping based on bays, but allows also for substation level applications
  - Interlocking
  - Protection coordination
  - Voltage and frequency protection based on voltage levels and/or substation sections





Other product features

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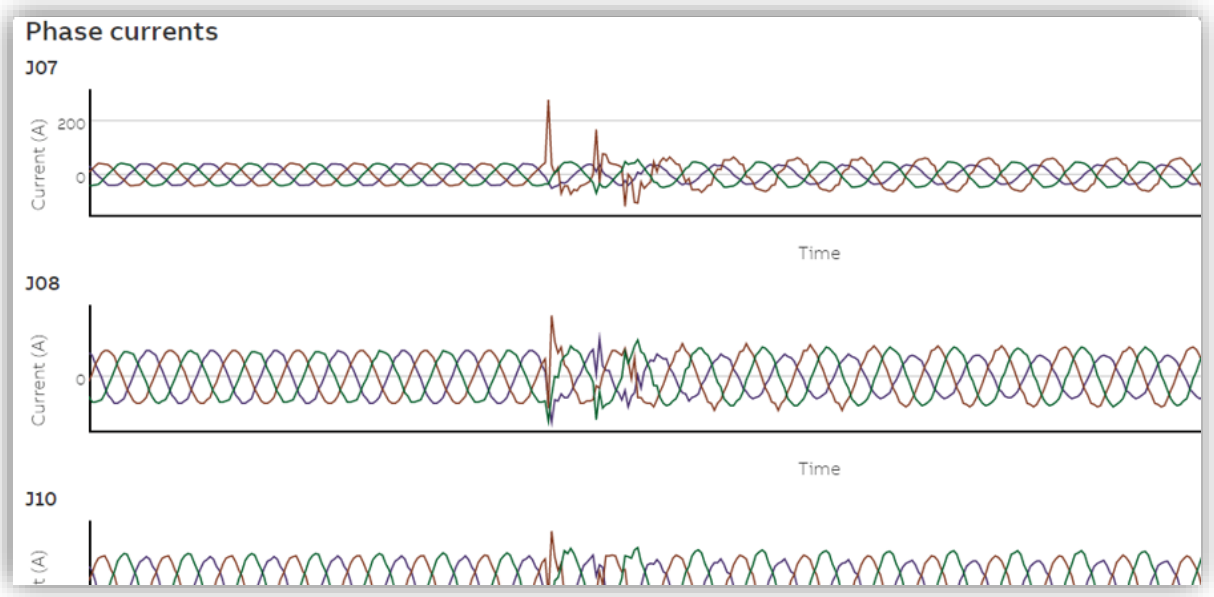
Station level disturbance recorder

Full visibility to network faults

SSC600 offers:

- Recordings of all received IEC 61850-9-2LE sample streams with 4 kHz sampling (up to 20 streams)
- Recordings of both phase quantities and phase-to-phase quantities
- Recordings of up to 512 Boolean signals
- Up to 99 latest records stored in COMTRADE format



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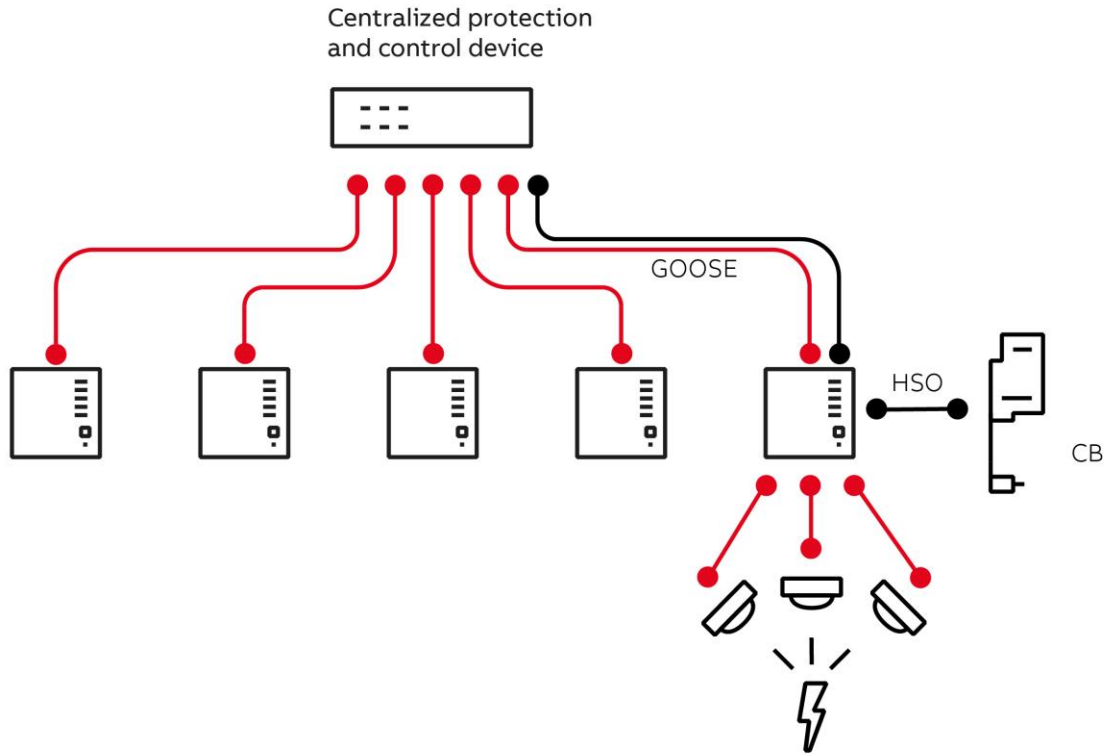
System safety

Arc protection

SSC600 offers:

- Arc protection function inputs for each bay available via installed merging unit (615/620 Series = 3, REX640 = 4)
- Light sensing from the merging units – transferred via GOOSE to SSC600
- High speed static outputs that will further enhance the performance of the protection scheme



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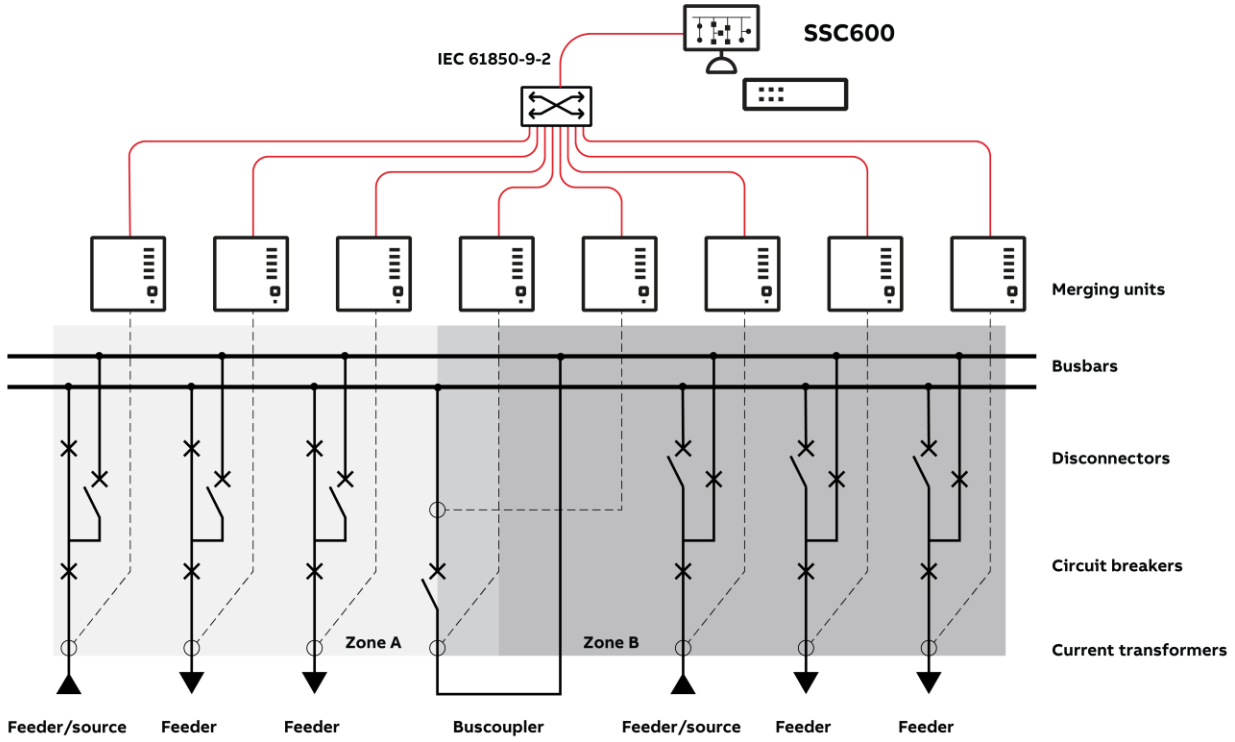
Simplified busbar protection

Busbar differential protection

SSC600 offers:

– Busbar differential protection
  - Based on low-impedance differential principle
  - With no need for extra equipment additionally to SSC600 and merging units
  - For up to 20 bays
  - With 2 protection zones plus a check zone
  - For single and double busbar configurations



Suggested solution examples

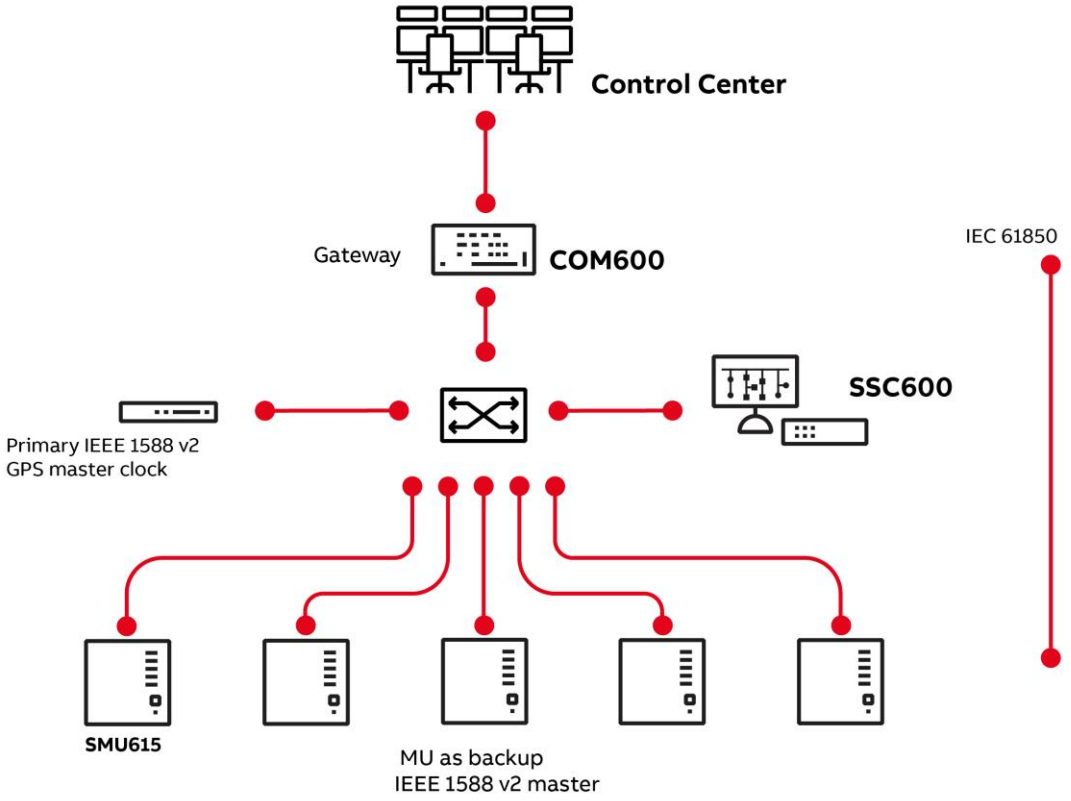
Smart substation control and protection SSC600

Smart substation control and protection SSC600

Suggested example solutions

Technical solution – centralized with single SSC600

- Solution consisting of a **system built with merging units** utilized in every bay/feeder
- Preferred **new installation use case** (all new equipment installed) – where centralized functionality is required
- A **single IEC 61850 network** for process and station bus
- **System visualization via SSC600 with WebHMI**
- **Time synchronization via IEEE1588v2 GPS master**
- Any smart merging unit can serve as backup time master
- Substation gateway doubles up as HMI
- Instead of external gateway, SSC600 can communicate directly to Control Center with IEC 61850 or IEC 104

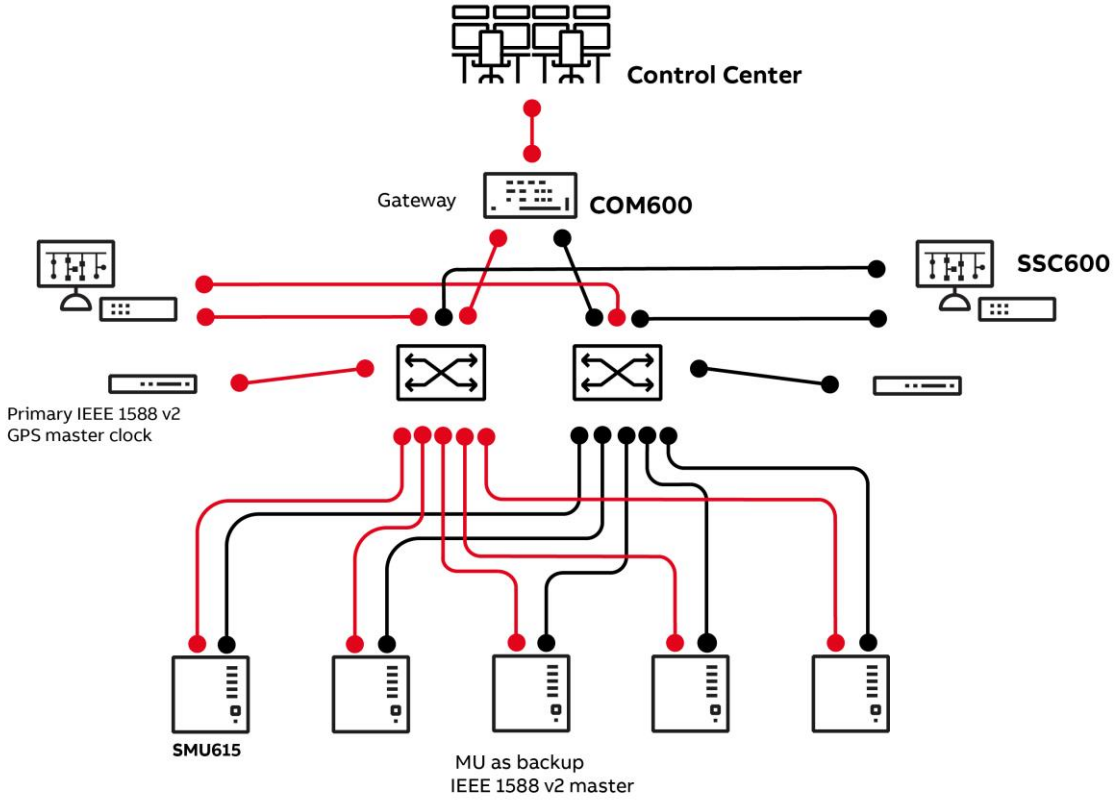


Smart substation control and protection SSC600

Suggested example solutions

Technical solution – Centralized with redundant SSC600

- Solution built with **merging units utilized in every bay/feeder** and redundancy with regards to
  - **Redundant SSC600 units** with
    hot-hot protection standby and,
    hot-standby control
  - **Communication** based on IEC 61850 PRP (process and station bus)
  - **Time synchronization** with
    IEEE1588v2 GPS master,
    merging unit as backup time master and,
    secondary GPS master also possible
- Preferred **new installation use case** (all new equipment installed) – where redundant centralized functionality is required
- **System visualization via SSC600 with WebHMI**
- **Substation gateway doubles up as HMI**
- Instead of external gateway, SSC600 can communicate directly to Control Center with IEC 61850 or IEC 104
- **Additional feature:** COM600S version 5.1 includes ease of use functionality to enhance redundant SSC600 operation

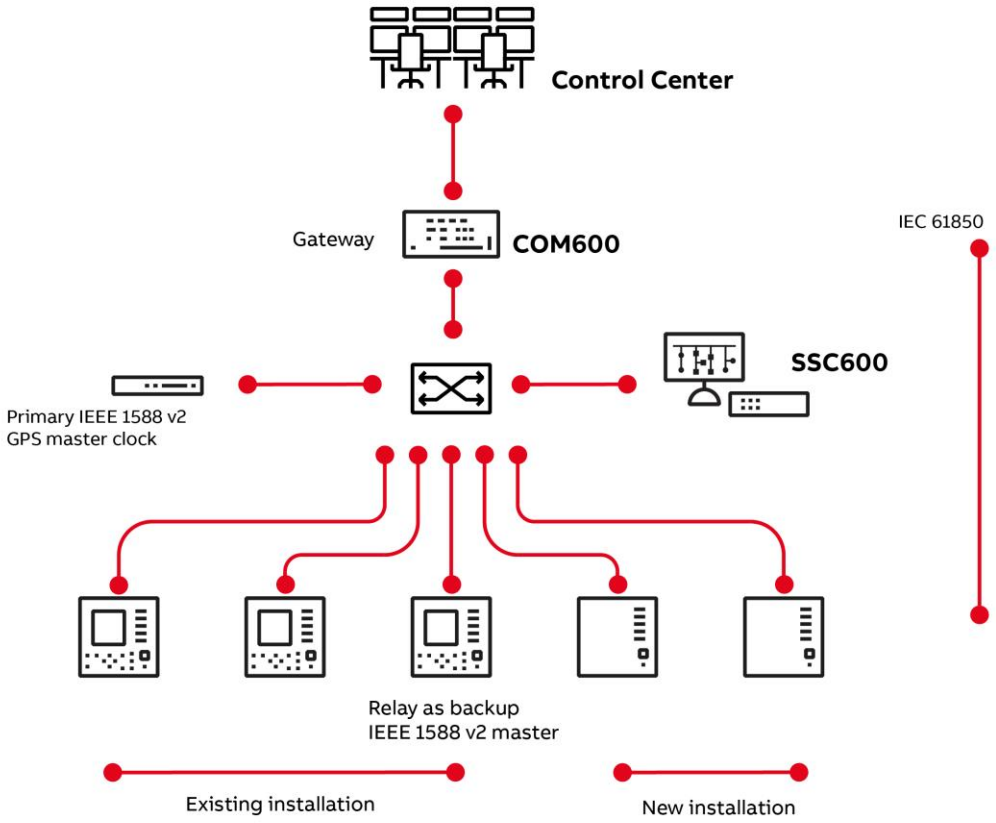


Smart substation control and protection SSC600

Suggested example solutions

Technical solution – Integrated / Retrofit

- Solution consisting of a **mixture of protection relay(s) with merging unit functionality and merging units** utilized in every bay/feeder
- Preferred **retrofit use case** (mix of existing and new) – where additional or upgrading of functionality is required
- A **single IEC 61850 network** for process and station bus
- **System visualization via SSC600 with WebHMI**
- **Time synchronization via IEEE1588v2 GPS master**
- Any capable protection relay can serve as backup time master
- Substation gateway doubles up as HMI
- Instead of external gateway, SSC600 can communicate directly to Control Center with IEC 61850 or IEC 104



Secure device management

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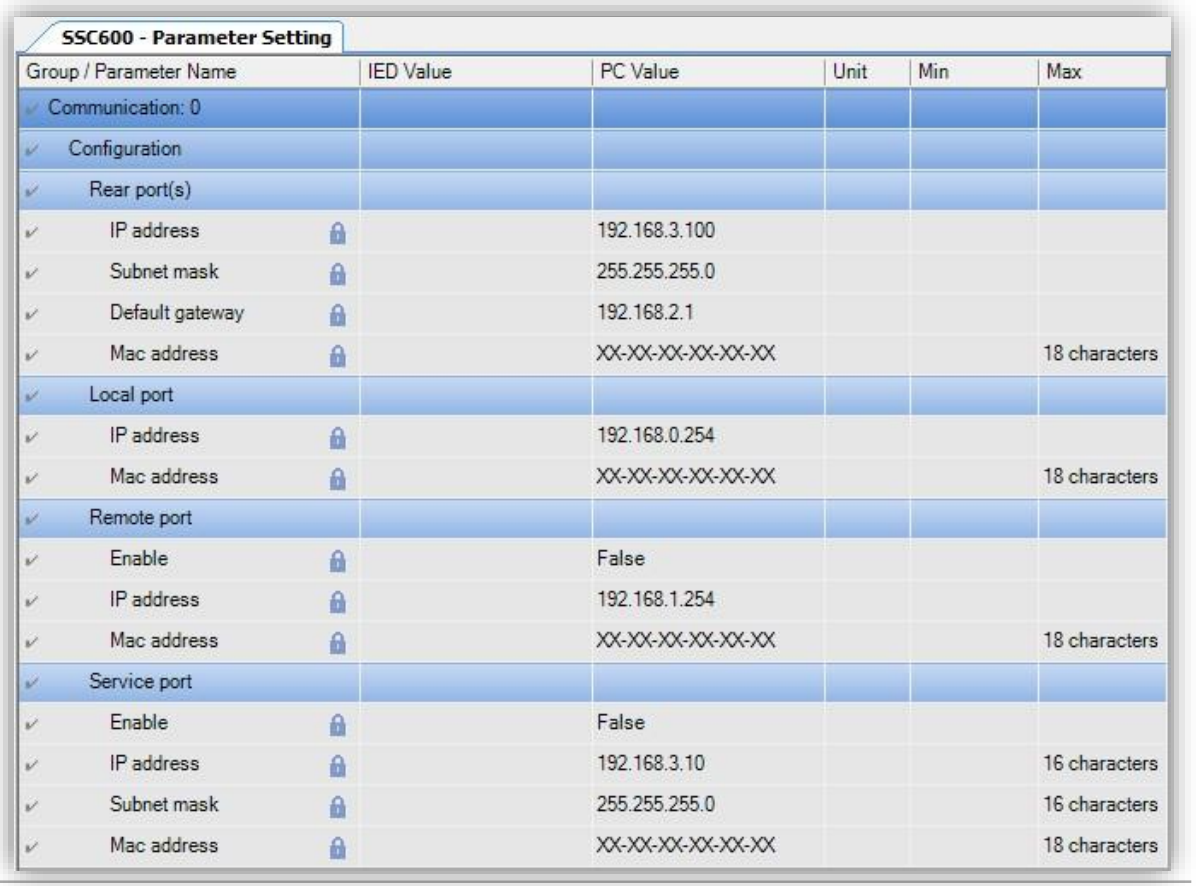
Multiple interfaces for different purposes

Improved security via different interfaces

SSC600 offers:

- Supports for the evolving cyber security standards and regulations for critical infrastructure
- Support for separating IEC 61850-9-2LE process bus to a separate network interface
- A separate local interface for single line diagram control
- A separate engineering interface with DCHP
- A separate service interface with its own IP address
- All network capable ports are closable
- All engineering communication is secured (HTTPS & FTPS)
- Role based access control
- Centralized security event logging with Syslog



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

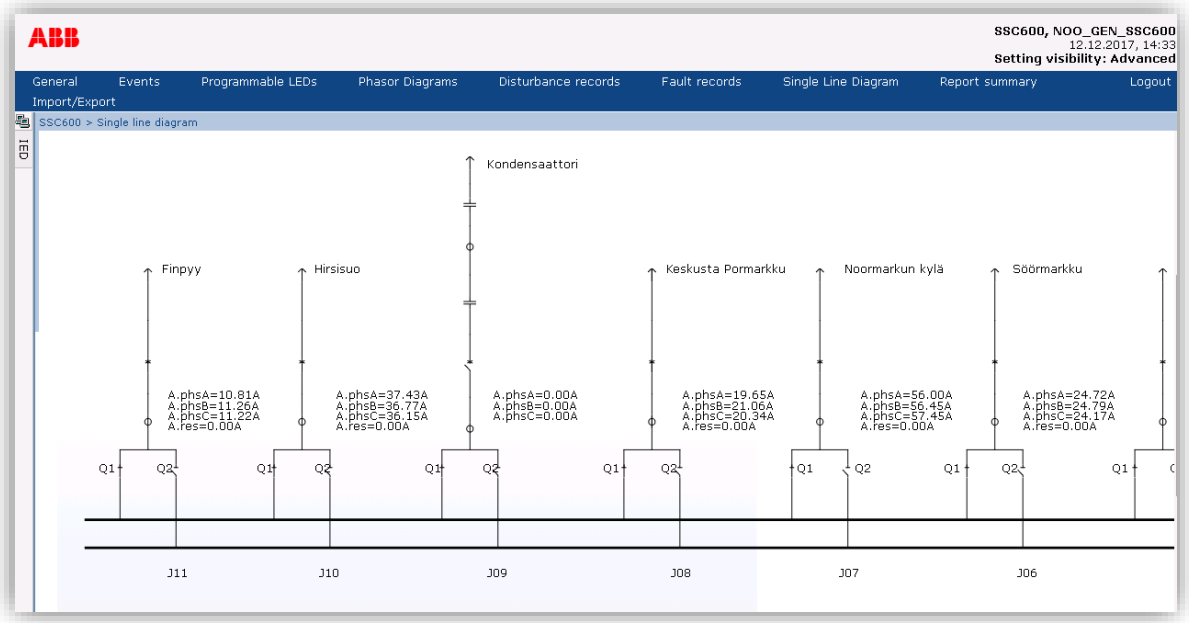
Smart substation control and protection SSC600

Extended remote update support

Remote update with automatic check and roll-back

SSC600 offers:

- Two separate firmware partitions, allowing for two separate firmware versions
- Automatic status check during update, with failures automatic roll-back to the previous version – secure remote update



Device ordering and modification

Smart substation control and protection SSC600

Smart substation control and protection SSC600

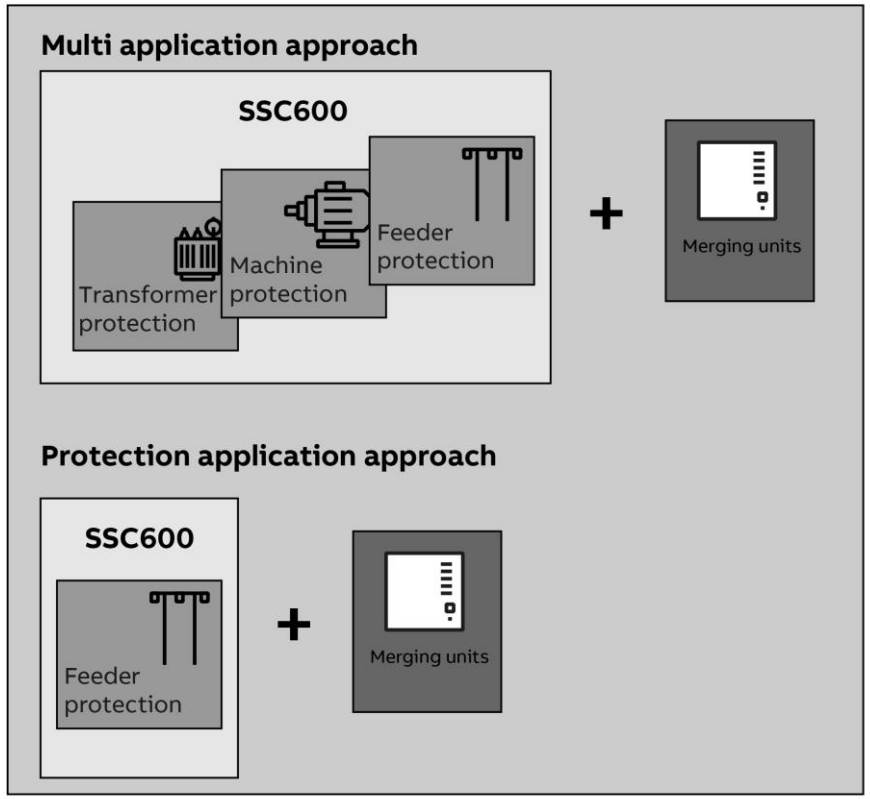
Device ordering and modification

Defining the relay variant for ordering

Device hardware and software functionalities can be selected independently from each other

- **Ordering SSC600**
  - Select amount of protected units (10-20 bays)
  - Select required software applications (feeder, Machine, transformer)
  - Select special protection
  - Select required HW options (power supply and communication)
- **Ordering ABB merging units or relays with MU capabilities**
  - Similar selection based on wanted HW and software options

- **Same Product Selection Tool (PST)** as for other Medium Voltage devices https://abbtm.fi.abb.com/PST/#/



Smart substation control and protection SSC600

Device ordering and modification

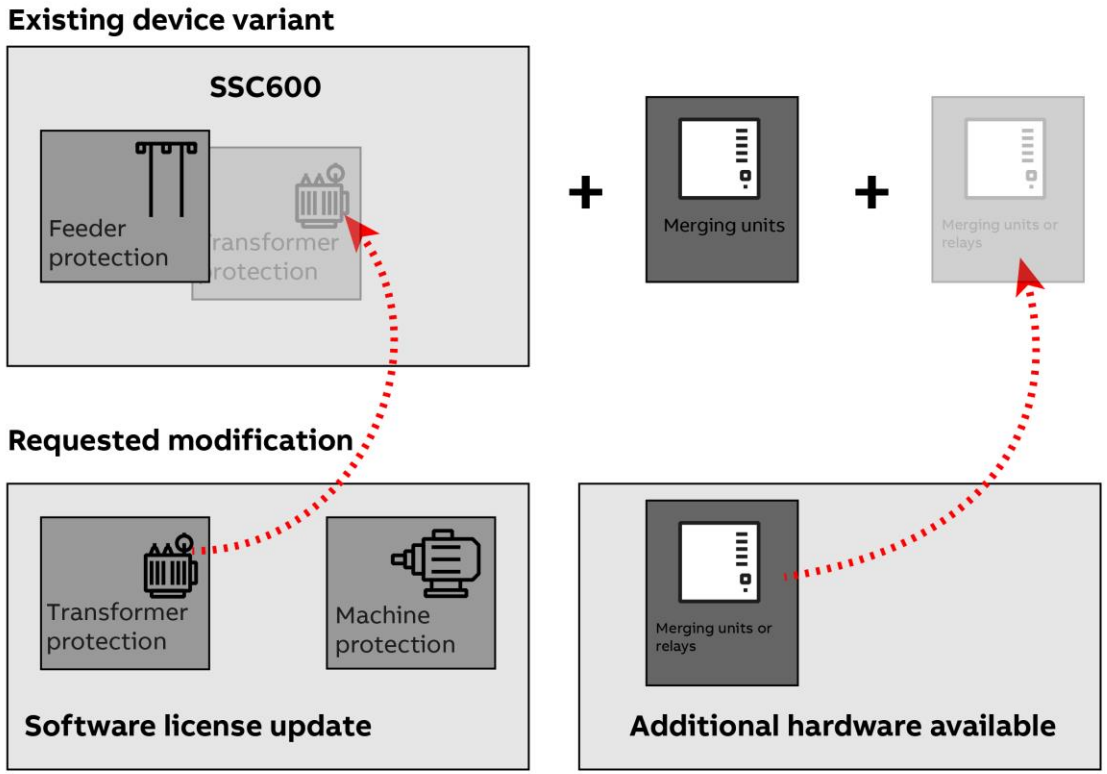
Modifying the delivered solution (Modification Sales)

The solution hardware and software functionalities can easily be **modified based on a license concept** called "**Modification Sales**"

- **Software**
  - Adding optional application package(s)
  - Updating and upgrading of protection functionality
- **Hardware**
  - Adding redundant SSC600 or merging unit

The same possibilities are available for modification as at the time of the initial order

Modification can be achieved via many routes, even done by the end-user on site



SSC600 digital services

Smart substation control and protection SSC600

Smart substation control and protection SSC600

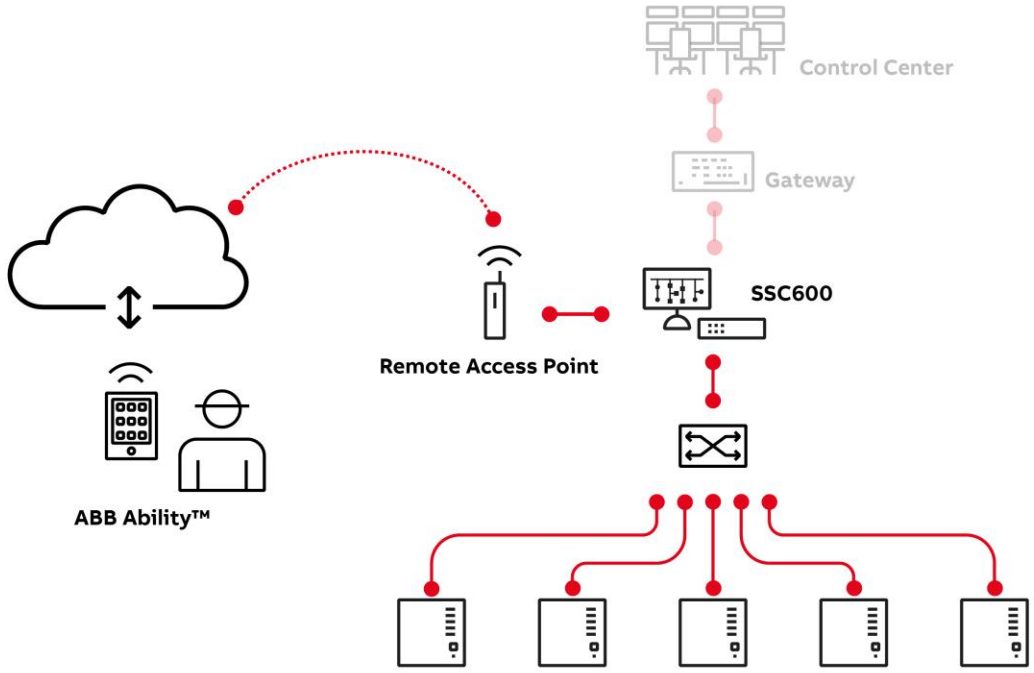
Digital services

Why digital services?

With **shortage of experienced personnel** to manage increasingly complex secondary installations, **additional help** is needed from external partners

SSC600 digital services offer:

- **Fast and personalized support** to minimise process downtime
- **Maximize performance and asset lifetime** by analysis and supervision of protection and control assets.
- **Saving time and money** with scheduled maintenance
- **Lowered operational risk** as you have access to latest and future upgrades and updates provided by ABB and extended warranty eligibility (requires registration of installed devices)
- **Additional support** for engineering available depending on service agreement.
- **Customized life cycle management services** (Extended Service Agreement)



Smart substation control and protection SSC600

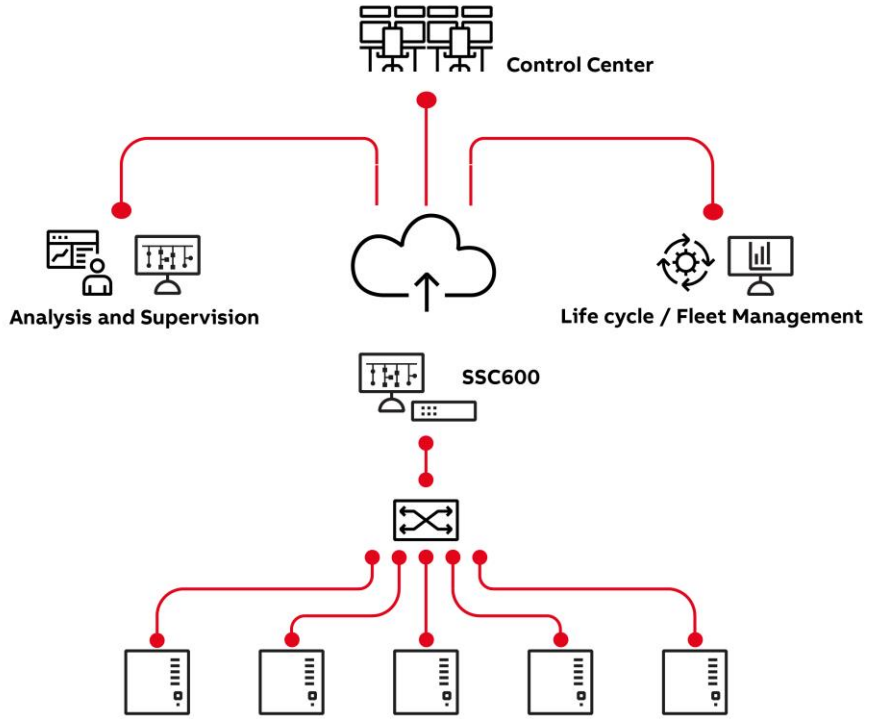
Digital services

Life Cycle Package - service tiers

– **Basic package**

Provides limited but powerful functionality for managing the asset data of any small or midsized installation and includes:

- Cyber Security updates
- Regular patch update information
- Configuration backups
- Access to subscription only webinars etc
- Access to Extended warranty and product license updates



Smart substation control and protection SSC600

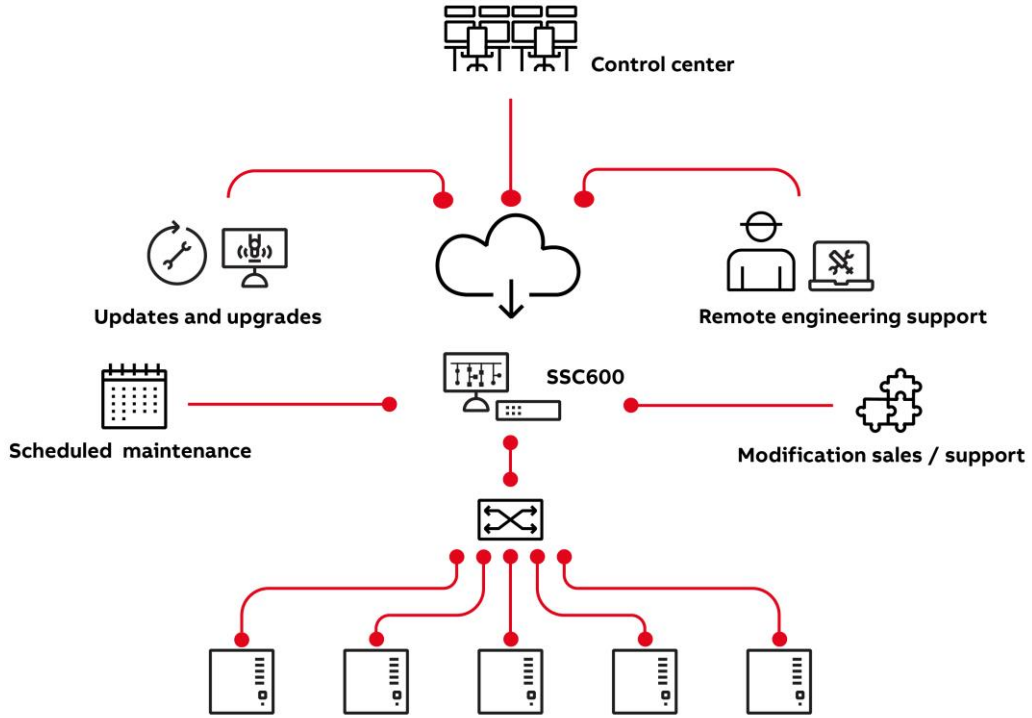
Digital services

Life Cycle Package - service tiers

– **Advanced package**

Provides the practical functionality included in the Basic package with additional useful functionality for an advanced user – typically in medium and large sized companies with several installations and an aim to make the most of their assets during its lifetime. It includes:

- Everything that is included in the “Basic”
- Access to technical support line
- Application consulting



Summary

Smart substation control and protection SSC600

Smart substation control and protection SSC600

Centralized protection for distribution substations

Complete application coverage with one device for optimal cost-effectiveness

- **ABB is constantly creating new ways to improve protection and control of medium voltage distribution systems**
- SSC600 introduces a **revolutionary way of thinking of protection and control in distribution networks**
- SSC600 offers some unique benefits compared to traditional P&C:
  - **Wider application range**
  - **Easy lifecycle handling**
  - **Visibility to the whole process**
- Centralized Protection and Control (CPC) based on international standards (IEC 61850) ensures system compatibility

A brand new way of thinking – taking protection and control to a new level


ABB