Centralized protection and control

Smart substation control and protection SSC600 and SSC600 SW

ABB

Contents

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Introduction

Introduction
Why centralized protection and control?

Product life cycle difference of existing primary equipment and secondary technology

Shortage of experienced personnel to manage increasingly complex secondary installations

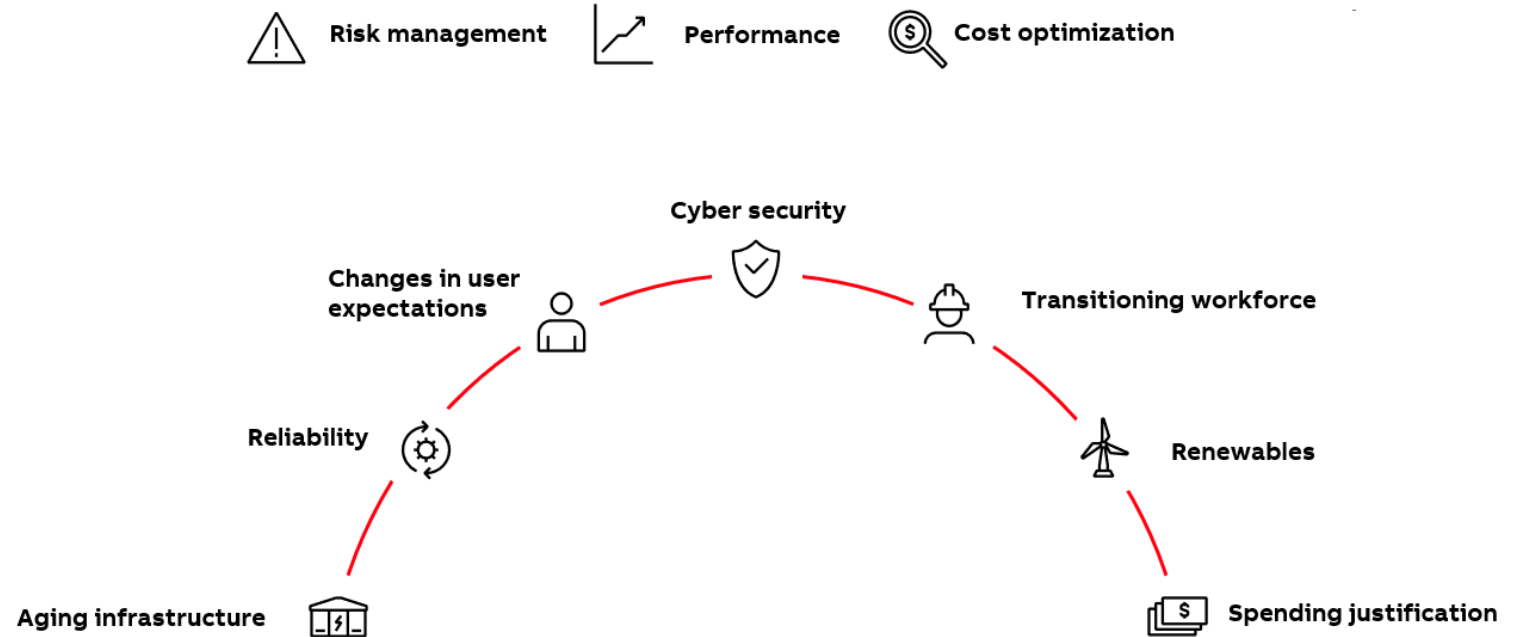Renewables and **distributed generation**

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

Need to automate with **smaller investment**

- Quicker deployment
- Inexpensive extensibility, upgrades and life cycle support
- High levels of flexibility, reliability, availability and safet

Standardized solutions based on IEC 61850

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

Risk management

Performance

Cost optimization

Cyber security

Changes in user expectations

Transitioning workforce

Reliability

Renewables

Aging infrastructure

Spending justification

Introduction
What is centralized protection and control?

- Protection and control functionality centralized in one device in the substation
- 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 base functionality and optional application packages
- Flexible combination of a wide range of protection and control functions to meet specific power system protection requirements
- Possibility to protect and control a wide variety of utility and industrial applications
- Testing and commissioning similar to that of a standard solution with injection of current and voltage signals to each SMU or Relion® relay acting as merging unit (MU)
- Extended capabilities with centralized protection and control (CPC) device, MUs and Relion protection and control relays forming a custom protection and control solution

Protection functionality

Control

Measurements

Centralized protection and control device
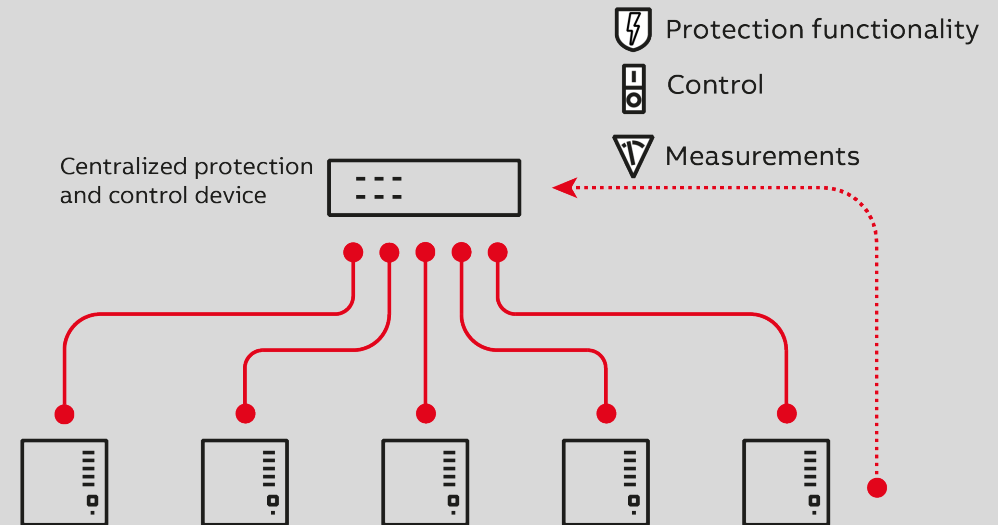
Introduction
Smart Substation Control and Protection SSC600

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.

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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.
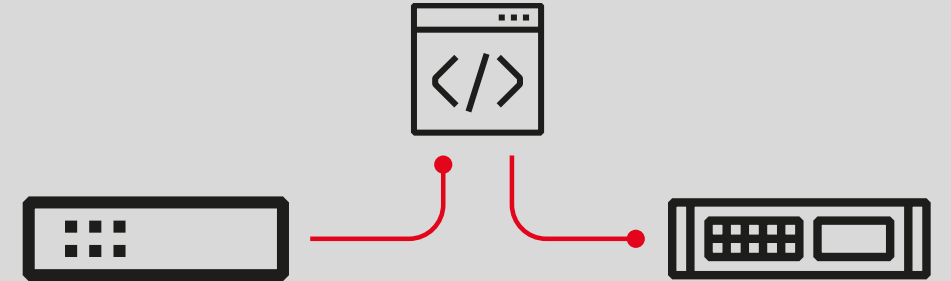
Introduction
Merging units

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)
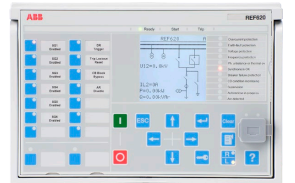
REX615

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

REX620

- Up to 10 CTs/4VTs or 8 CTs/9VTs
- 50 I/Os
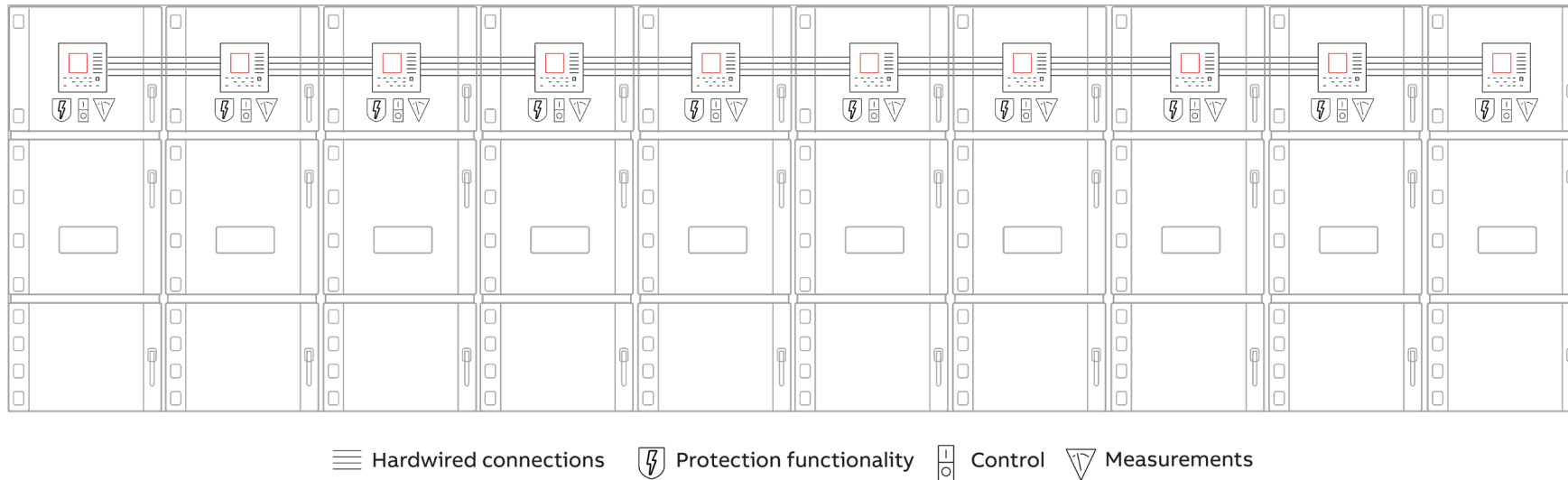
REX640

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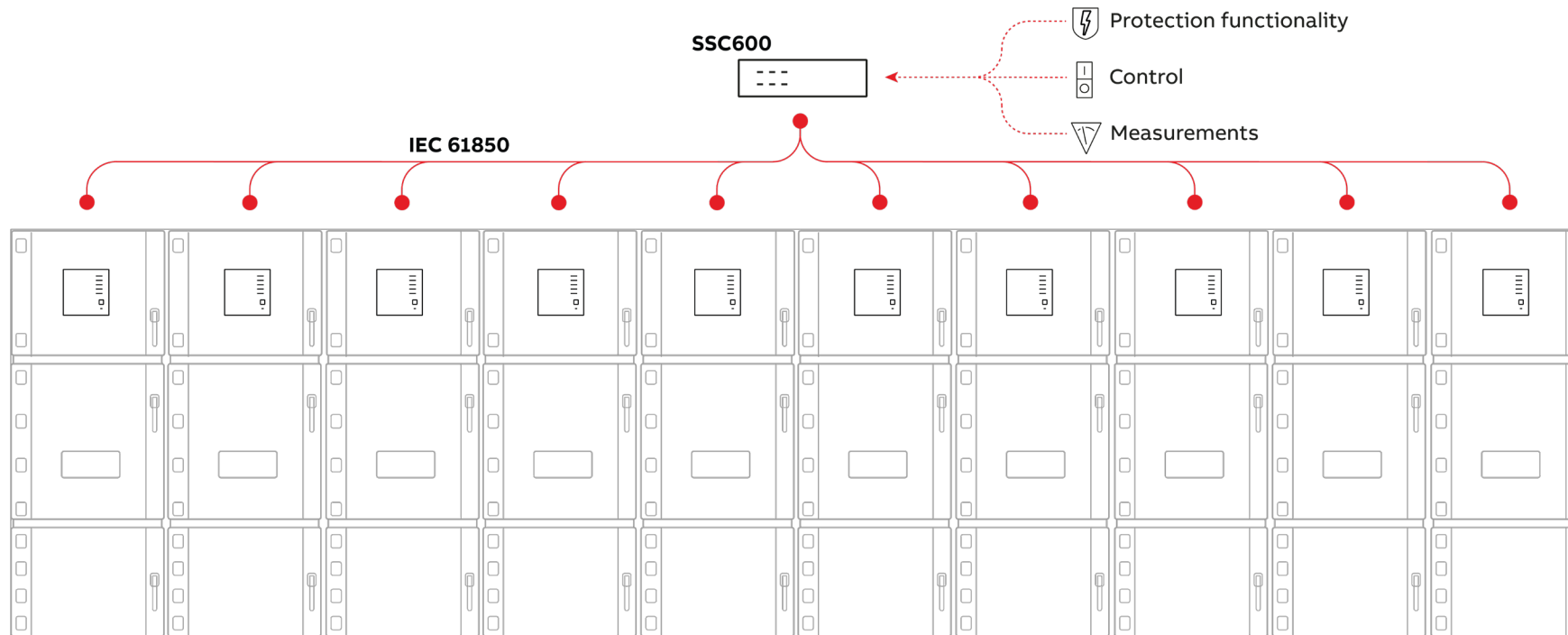
Introduction

Traditional substation protection, control and measurement

Hardwired connections　　Protection functionality　　Control　　Measurements

Introduction

Centralized protection and control with SSC600

Introduction
What is new?

SSC600 1.0 Feature Pack 4

- Virtualized protection and control – SSC600 SW
- Capacitor bank protection
- New WHMI
- Simulation according to IEC 61850
- Disturbance recorder enhancements

SSC600 1.0 Feature Pack 3

- Support for larger installations (up to 30 bays)
- Routable GOOSE according to IEC 61850-90-5

SSC600 1.0 Feature Pack 2

- IEC 60870-5-104 support
- Usability improvements for WHMI

SSC600 1.0 Feature Pack 1

- Busbar differential protection
- Advanced cybersecurity (RBAC, syslog, certificates)

Customer benefits

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

Station-wide/multi-feeder coverage

SSC600

Centralized protection and control

IEC 61850

Merging units - SMU615

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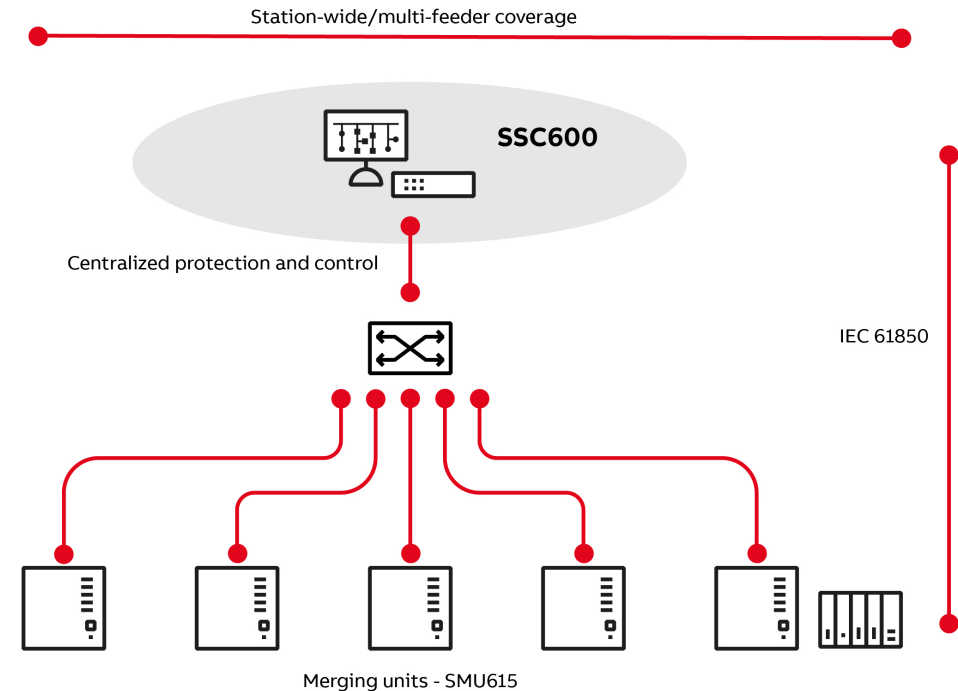
Customer benefits
Protection flexibility for changing power grids

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

Station-wide/multi-feeder coverage

SSC600

Centralized protection and control

IEC 61850

Merging units - SMU615

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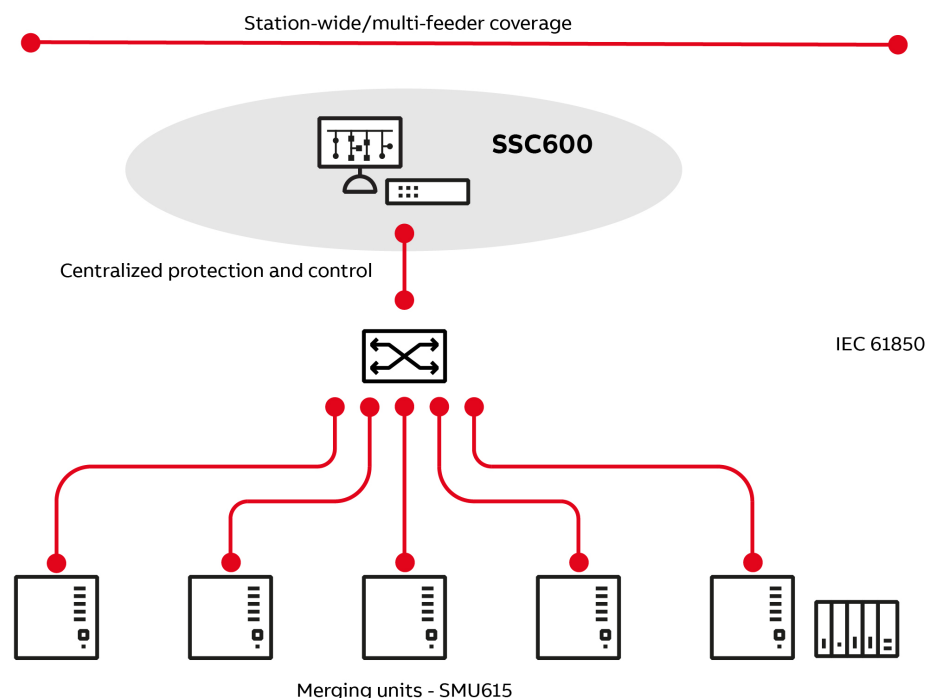
Customer benefits
Ease of use for increasingly complex systems

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

Station-wide/multi-feeder coverage

SSC600

Centralized protection and control

IEC 61850

Merging units - SMU615
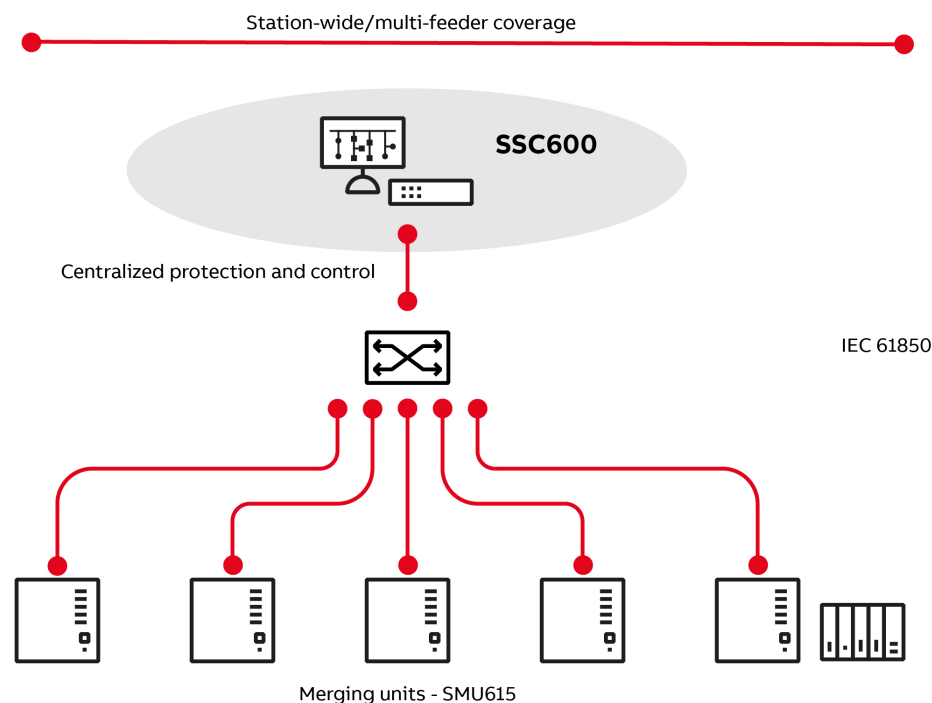
Application coverage

Application coverage

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
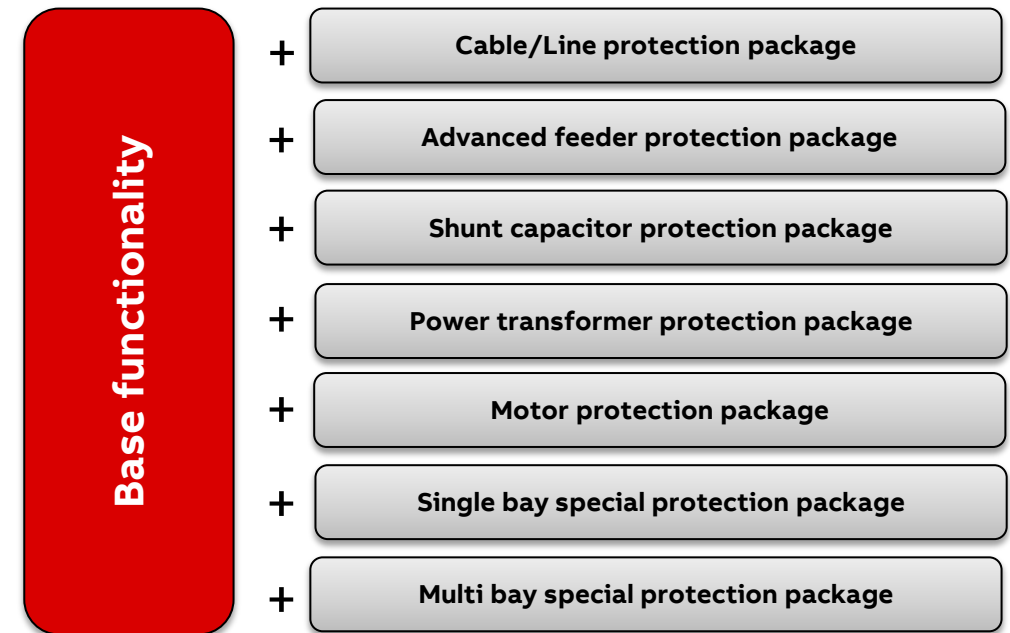
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Application packages

Application packages
Overview

The functionality is divided into:

- **Comprehensive base functionality** – always included

- **7 application packages (optional)** – freely selected as required by the intended application – none, some or all

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

Base functionality

+ Cable/Line protection package

+ Advanced feeder protection package

+ Shunt capacitor protection package

+ Power transformer protection package

+ Motor protection package

+ Single bay special protection package

+ Multi bay special protection package

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Application packages

Package content

Base functionality (always included)

Functionalities	Basic protection
Web HMI with station SLD	Current protection_50/51
Breaker monitoring	Earth-fault_50N/51N
Measurements_3I/3V/In/Vn/f/…	3-phase undervoltage_27
Fault recorder	3-phase overvoltage_59
Disturb. recorder (centralized)	Residual overvoltage_59N
IEC61850-9-2LE SMV receiving	Neg.seq. overvoltage_47O-
IEC61850 GOOSE/ R-GOOSE/MMS	Pos.seq. undervoltage_47U+
Advanced logics	Negative-sequence OC_46
Alarms	Frequency protection_81
Events and audit log	Fuse failure supervision_VCM,60
PRP redundant communication	Three-phase inrush detect._68HB
Redundant power supply	Circuit-breaker failure_51BF
Time synch. with IEEE 1588 v2	Master trip_94/86
IEC 60870-5-104	Switch onto fault_SOTF
Anomaly detector ANOGAPC	Load blinder_21LB

Cable/line application (5-10-15-20-30 bays)

Directional EF_67N
3-ph. direct. reverse power_32R/32O
Phase-discontinuity_46PD
Thermal protection_49F
Autoreclosing_79
Synchrocheck_25
Directional OC_67P

Advanced cable/line application (5-10-15-20-30 bays)

MF-admittance EF_67NYH
Admittance EF_21YN
Intermittent EF_67NIEF
Wattmetric EF_32N
Low-voltage ride-through protection_27RT
Fault locator_21FL
Direct. react. power underv._32Q/27

Transformer protection (0-2-4 bays)

Thermal overload_49/T/G/C
Transformer differential_87T
Low-impedance REF_87NL
3-phase underimpedance_21G
Tap-changer position indication_84M

Motor application (0-5-10-15-20-30 bays)

Thermal overload_49M
Neg.seq. OC for machines_46M
Loss of load supervision_37
Motor load jam_51LR
Motor startup supervision_49/66/48/51LR
Phase reversal 46R
Emergency startup_ESTART

Bay-level applications (for selected and available streams)

Tap-changer indication and control with voltage regulator
Distance protection_21P, 21N
Power quality • Current total demand and harmonic distortion (TDD and THD) • Voltage total harmonic distortion (THD) • Voltage variation • Voltage unbalance

Multi-bay level applications (up to 30 bays)

Load-shedding and restoration across 4 bus sections_81LSH
Low imp. busbar differential_87BL/87B
Arc protection_50L/50NL

Shunt capacitor protection

3-ph overload_51,37,86C
Current unbalance_60N
3-ph current unbalance_60P
Cap. bank switching resonance_55ITHD

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Software and hardware modularity

Software and hardware modularity
## Modify as you need

Modular software that allows you to create your own, unique solution for your specific protection requirements

Customer-oriented license-based modification concept for adding software and/or hardware according to user needs when requirements 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 done on site - by end-users - without network or cloud access

Advantage of only having to engineer or modify one device instead of all bay-level protection and control devices

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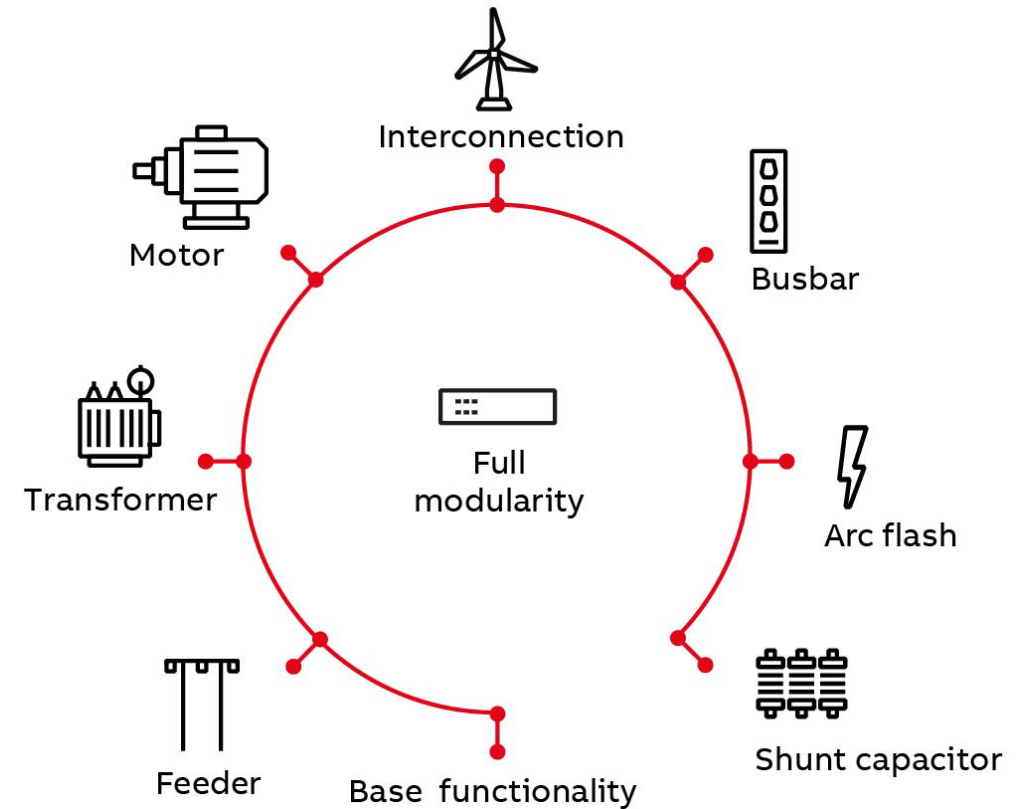
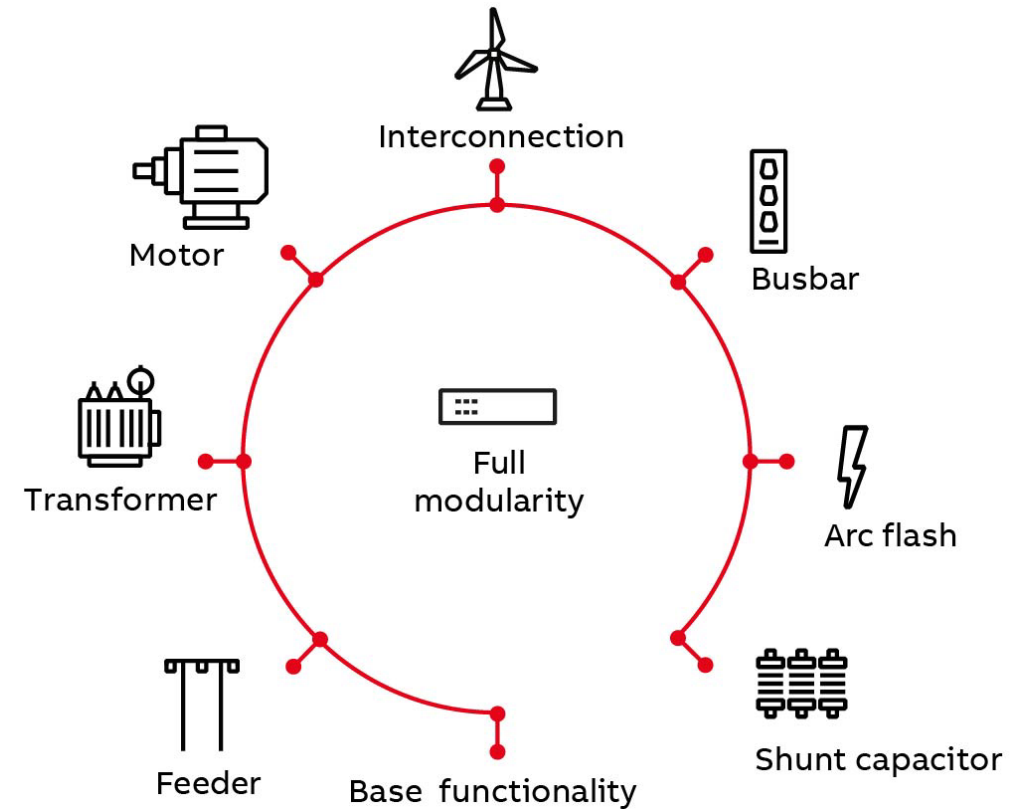# Software and hardware modularity
Hardware options

Same hardware for all available applications

Only two needed ordering options:

- Redundant power supply – high or low voltage
- Optional communication module for optical connections

Or order only the software – SSC600 SW
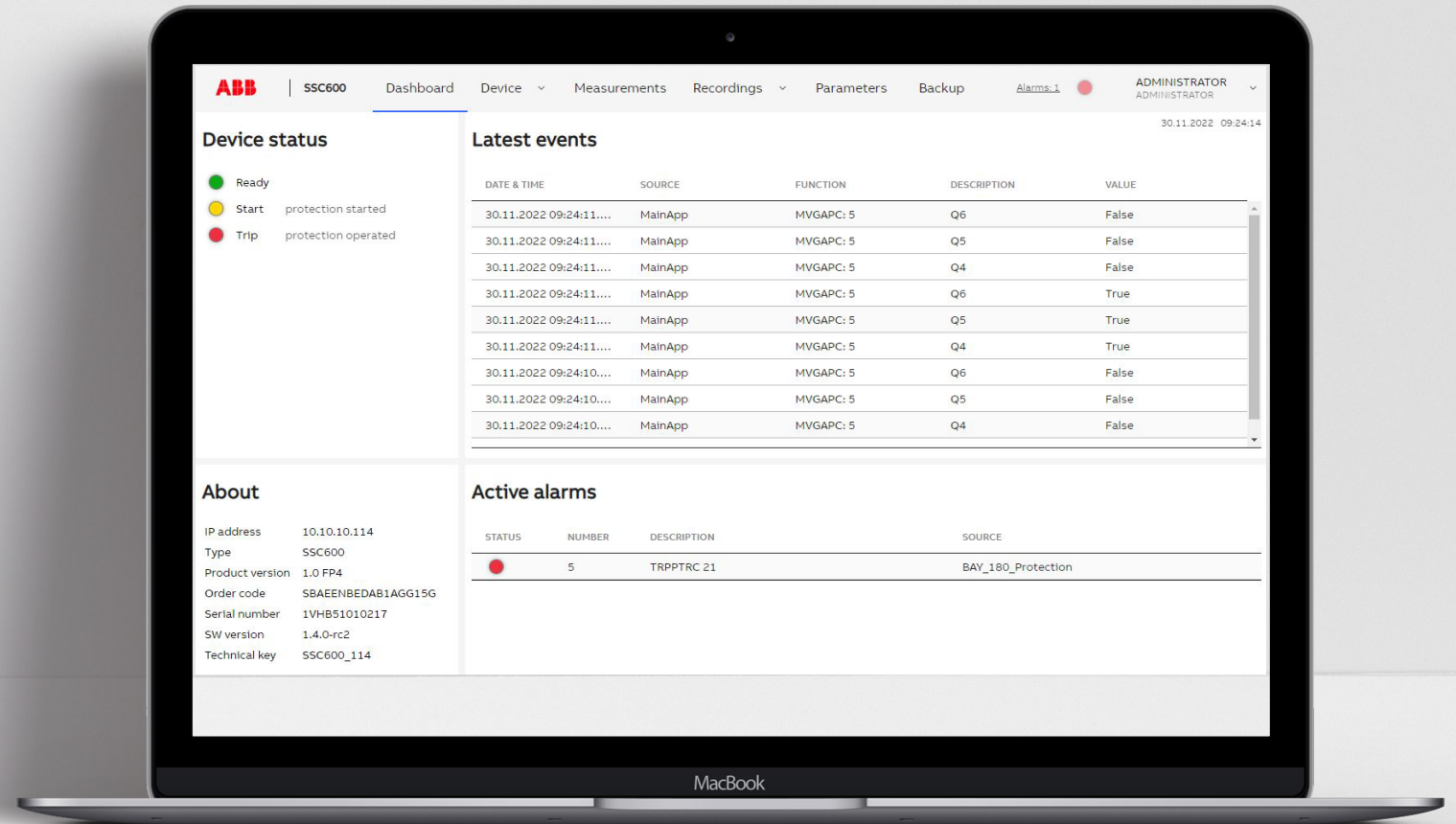
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Human-machine interface

Human-machine interface
Easy operation via Web HMI (WHMI)

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
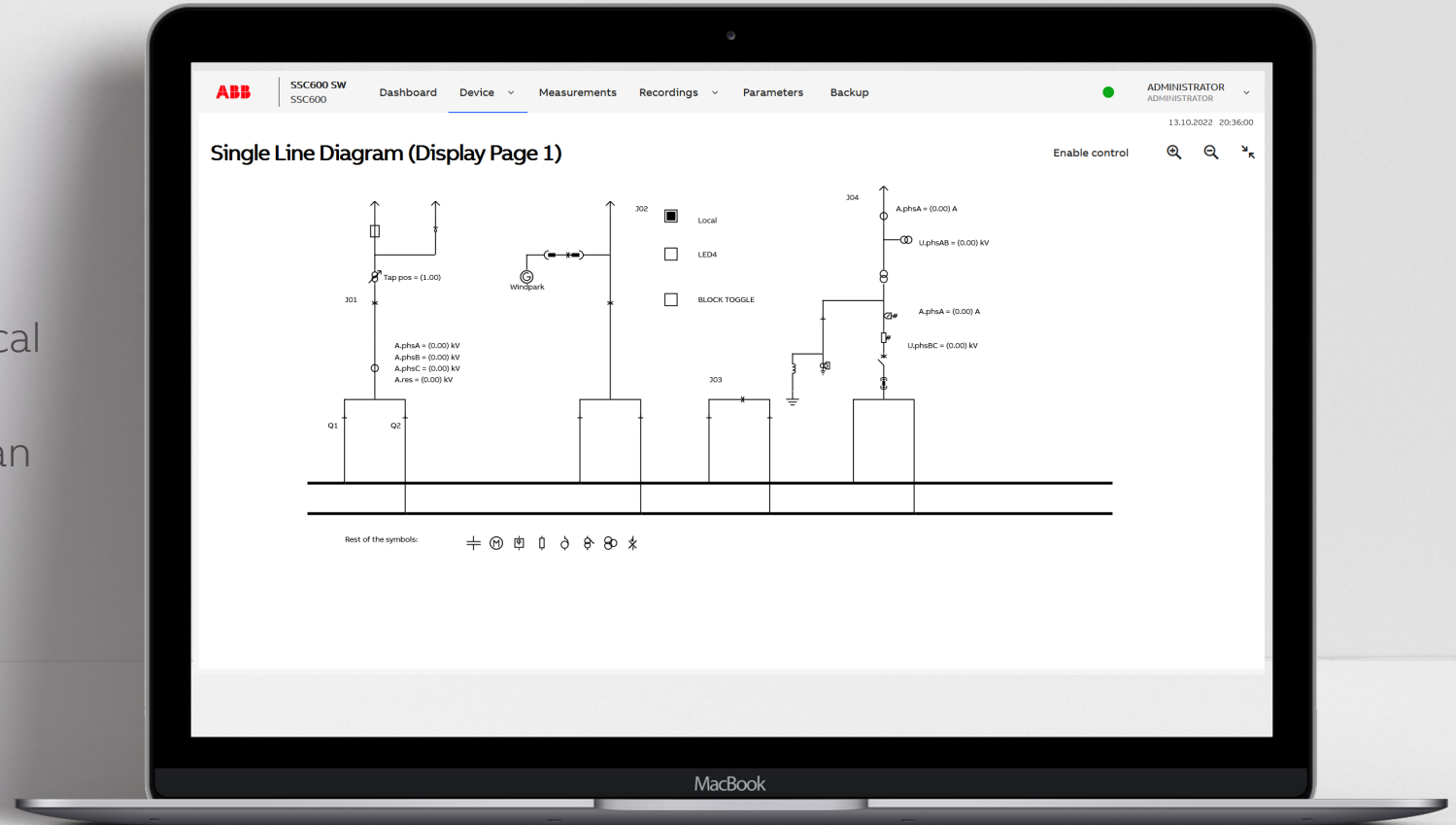
Local or remote location of the HMI enabled

Human-machine interface
Substation-level single line diagram

Visibility and control of the whole substation via the single line diagram (SLD)

Secure management of control access

- Control is only allowed from dedicated local interfaces

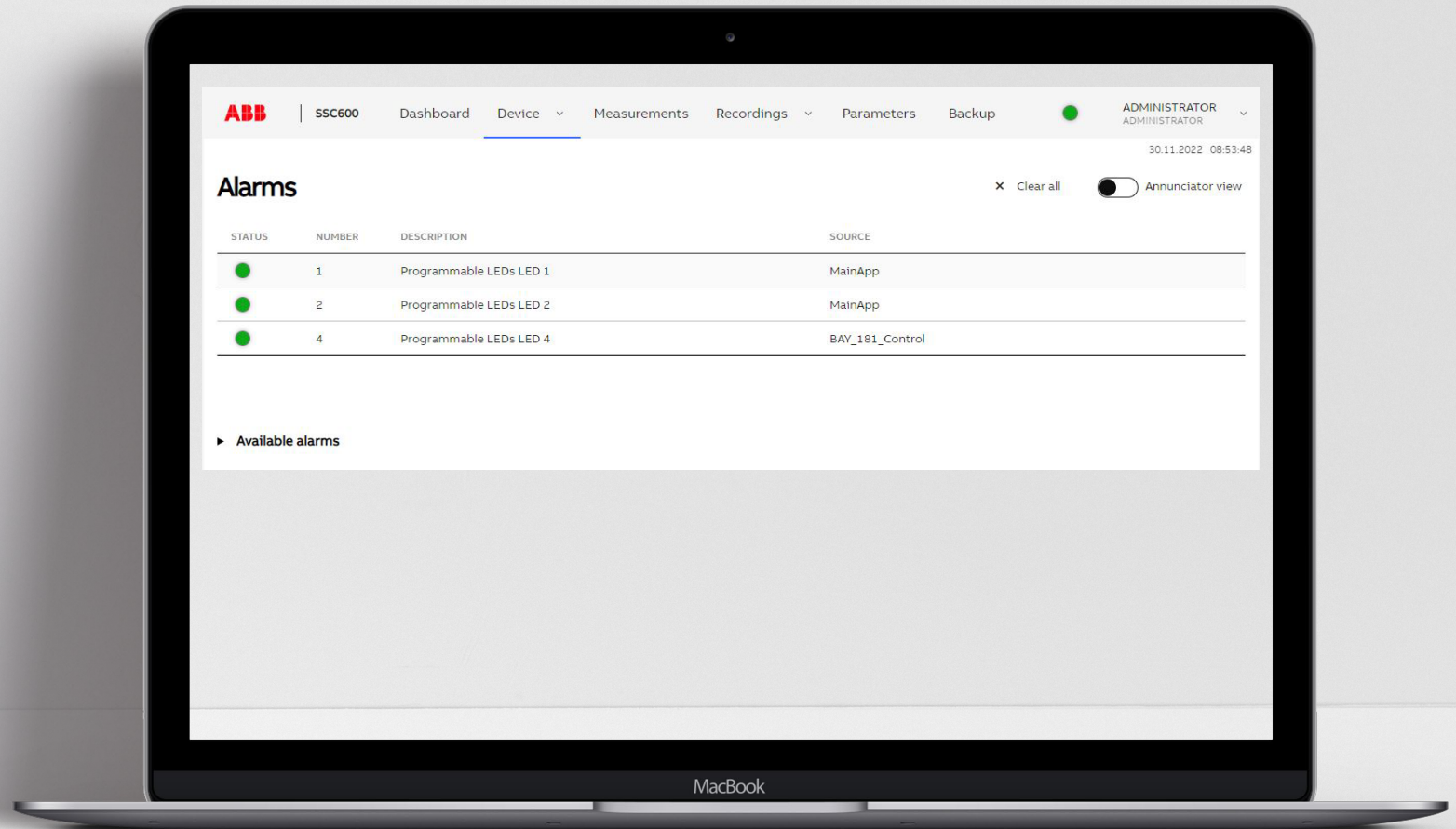- Only monitoring is allowed from other than dedicated local interfaces

Human-machine interface
Substation-level alarm handling

Up to 99 virtual alarm LEDs for all kinds of substation-level alarms

Centralized alarm center for the substation

Alarms as list or in annunciator view (SACO)

ABB	SSC600	Dashboard Device ⌄ Measurements Recordings ⌄ Parameters Backup	● ADMINISTRATOR ADMINISTRATOR ⌄

30.11.2022 08:53:48

Alarms

✕ Clear all   ⬤ Annunciator view

STATUS	NUMBER	DESCRIPTION	SOURCE
●	1	Programmable LEDs LED 1	MainApp
●	2	Programmable LEDs LED 2	MainApp
●	4	Programmable LEDs LED 4	BAY_181_Control

▶ Available alarms

MacBook

Human-machine interface
## Settings management in WHMI – grouping of functions

Clear categorization of settings based on application needs

- Easy to manage bay-specific settings via the WHMI

Synchronization with the application categorization done in the engineering phase with Protection and control IED manager 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
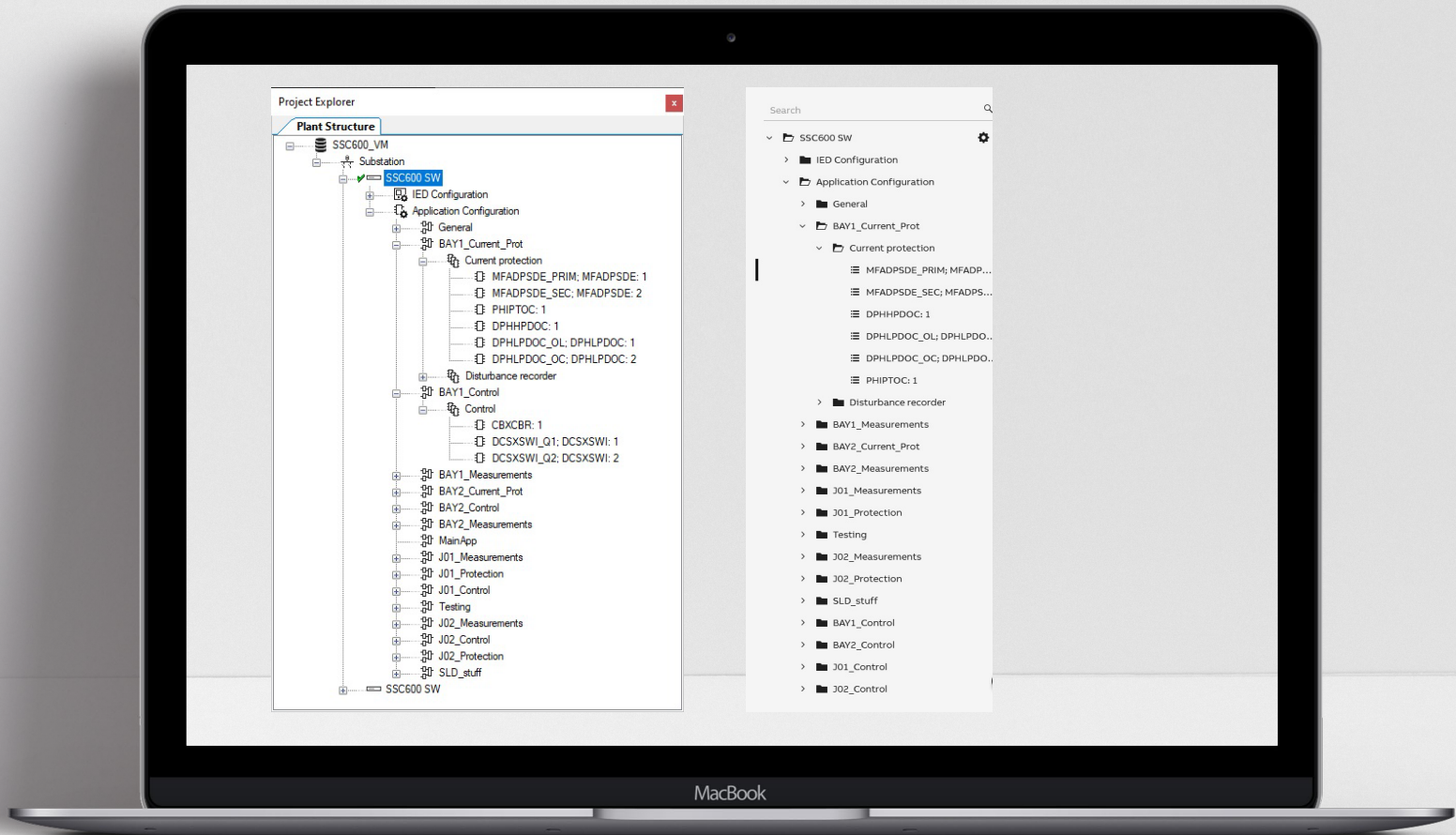
Other product features

Other product features
Station-level disturbance recorder

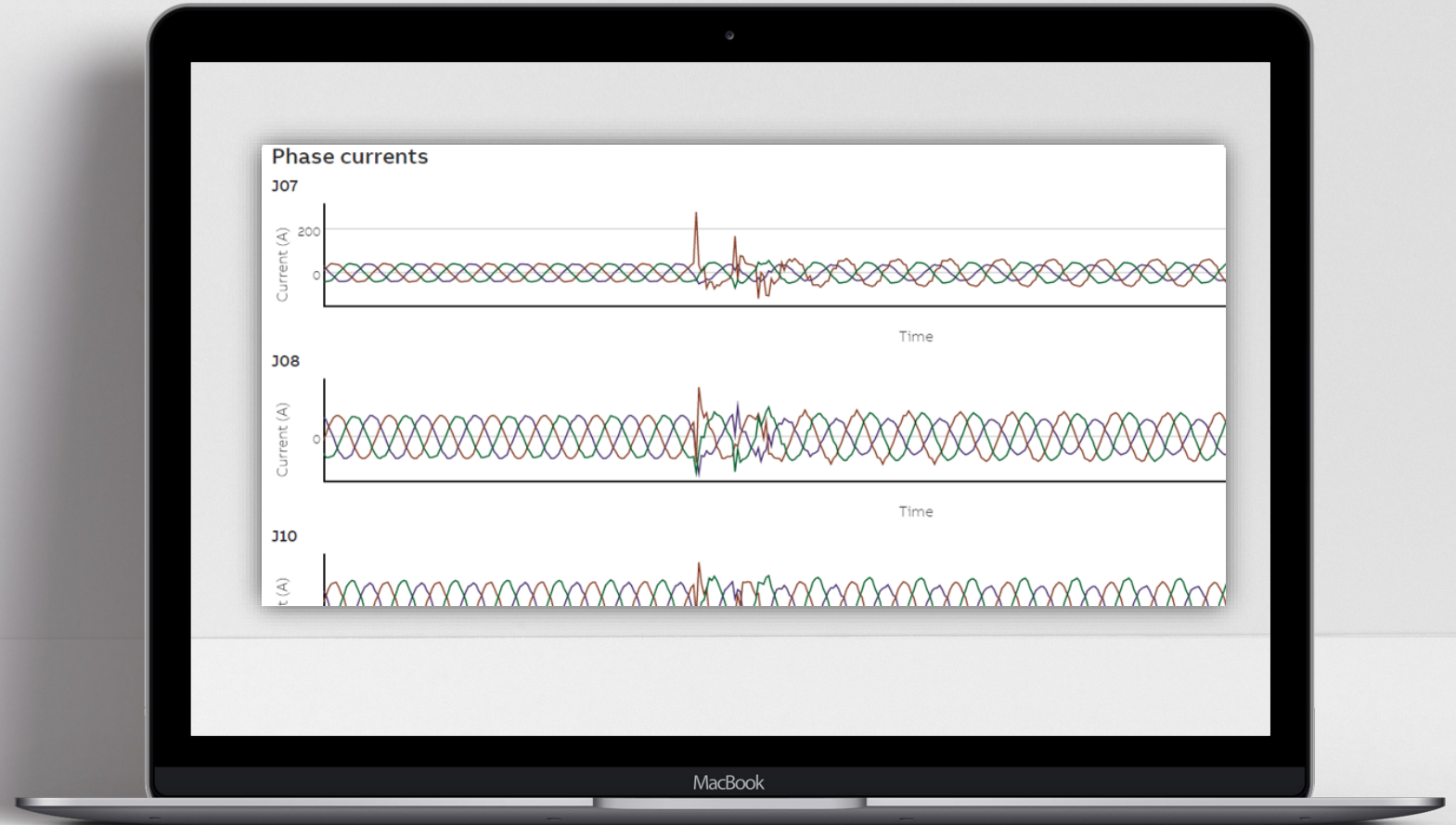Recordings of all received IEC 61850-9-2LE sample streams with 80 samples per second (up to 30 streams)

Recordings of both phase quantities and phase-to-phase quantities

Recordings of up to 512 Boolean signals

Storage space for thousands* of COMTRADE files

Maximum recording length 60 seconds

Trigger recordings with dedicated anomality detection function
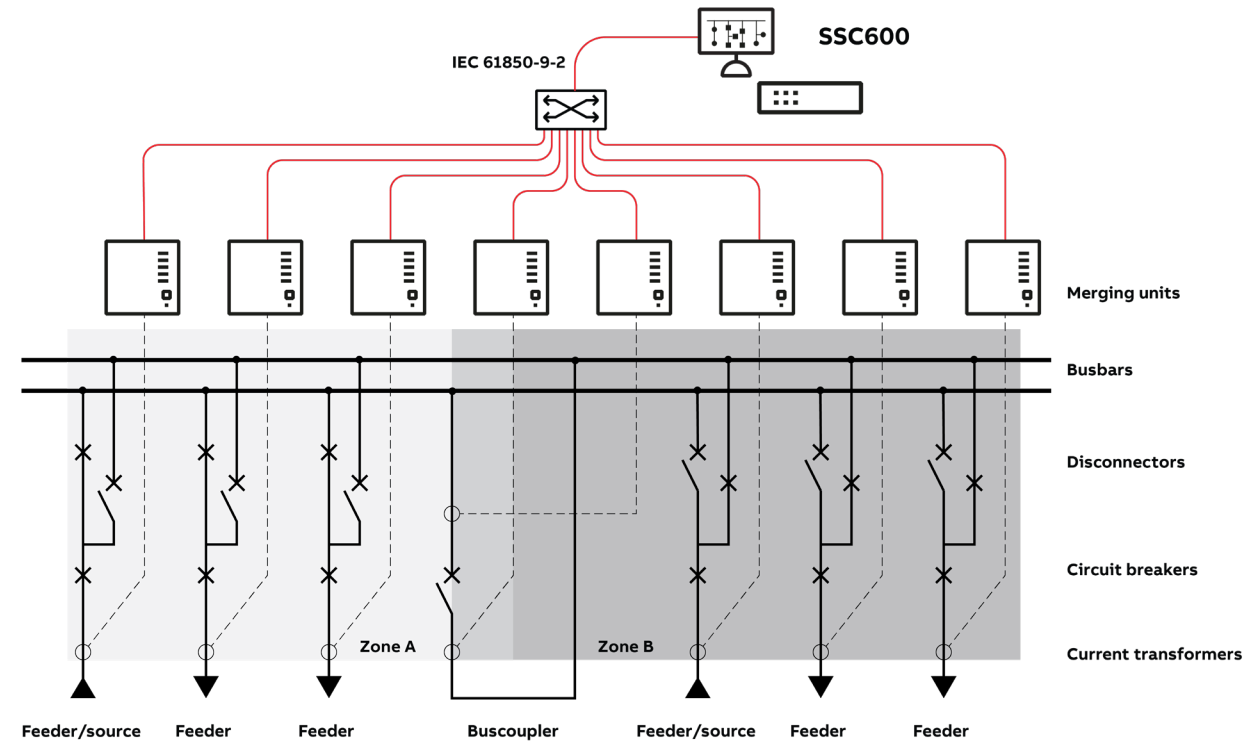
Other product features
Arc flash protection

- Arc flash protection function inputs for each bay available via installed MU (Relion 615/620 series = 3, REX640 = 4)

- Light sensing from the MUs – transferred via GOOSE to SSC600

- High-speed static outputs that will further enhance the performance of the protection scheme

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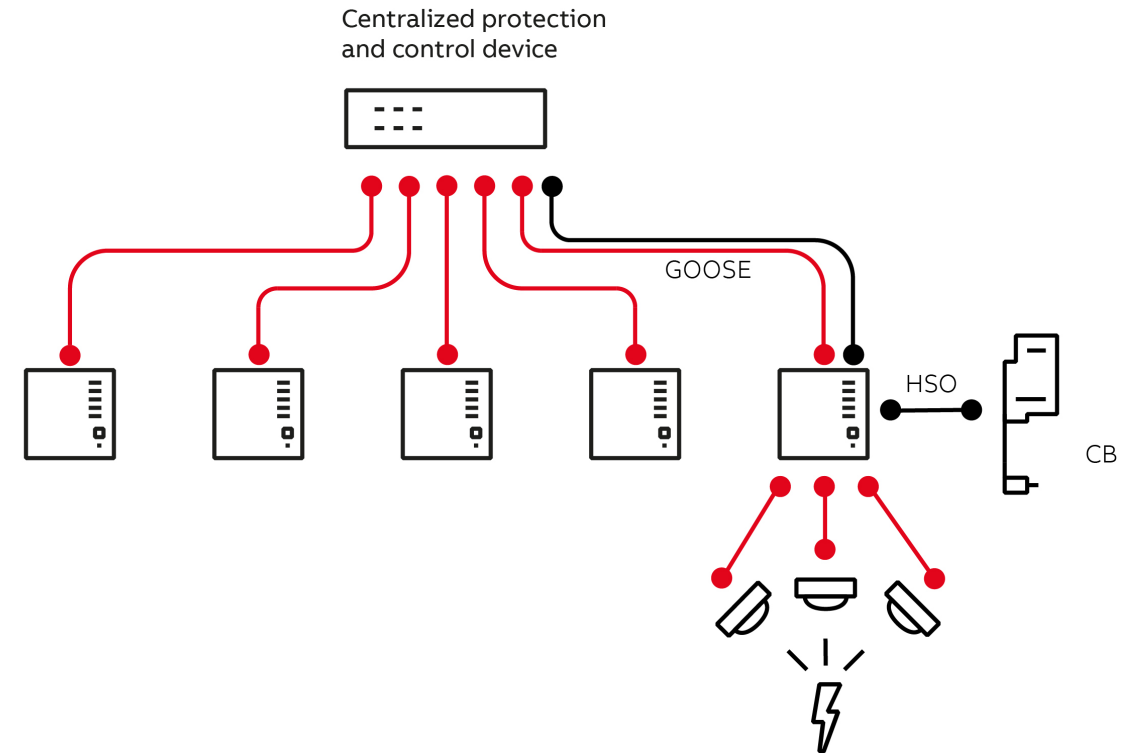
Other product features
Busbar differential protection

- Based on low-impedance differential principle
- With no need for extra equipment additionally to SSC600 and MUs
- For up to 30 bays
- With four protection zones plus a check zone
- For single and double busbar configurations
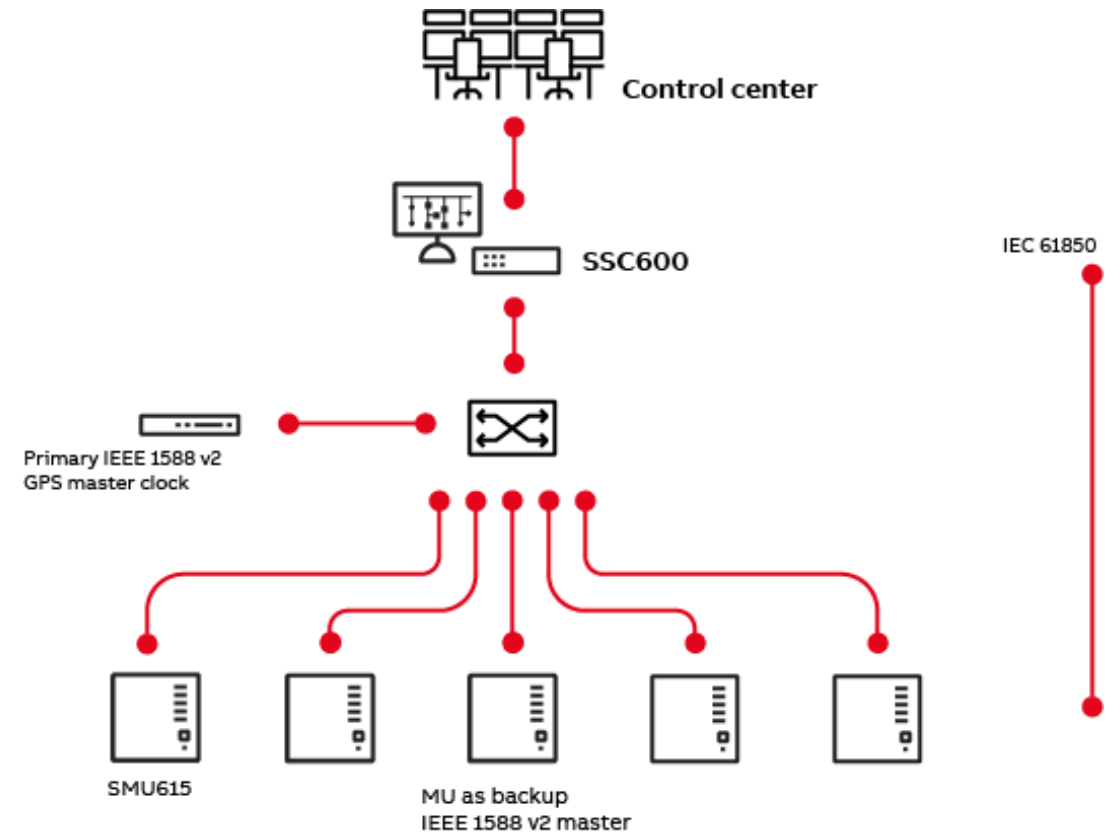

IEC 61850-9-2

SSC600

Merging units

Busbars

Disconnectors

Circuit breakers

Current transformers

Zone A

Zone B

Feeder/source   Feeder   Feeder   Buscoupler   Feeder/source   Feeder   Feeder

Solution examples

Solution examples
Centralized protection and control with a single SSC600

- Solution consisting of a **system built with MUs** 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 using SSC600 and its WHMI**
- **Time synchronization via the IEEE 1588 v2 GPS (Global Positioning System) master**
- Any MU can act as backup time master
- Direct communication to the control center possible with IEC 61850 or IEC 60870-5-104, without an external gateway in between

Control center

SSC600

IEC 61850

Primary IEEE 1588 v2
GPS master clock

SMU615

MU as backup
IEEE 1588 v2 master

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Solution examples
Centralized protection and control with a redundant SSC600

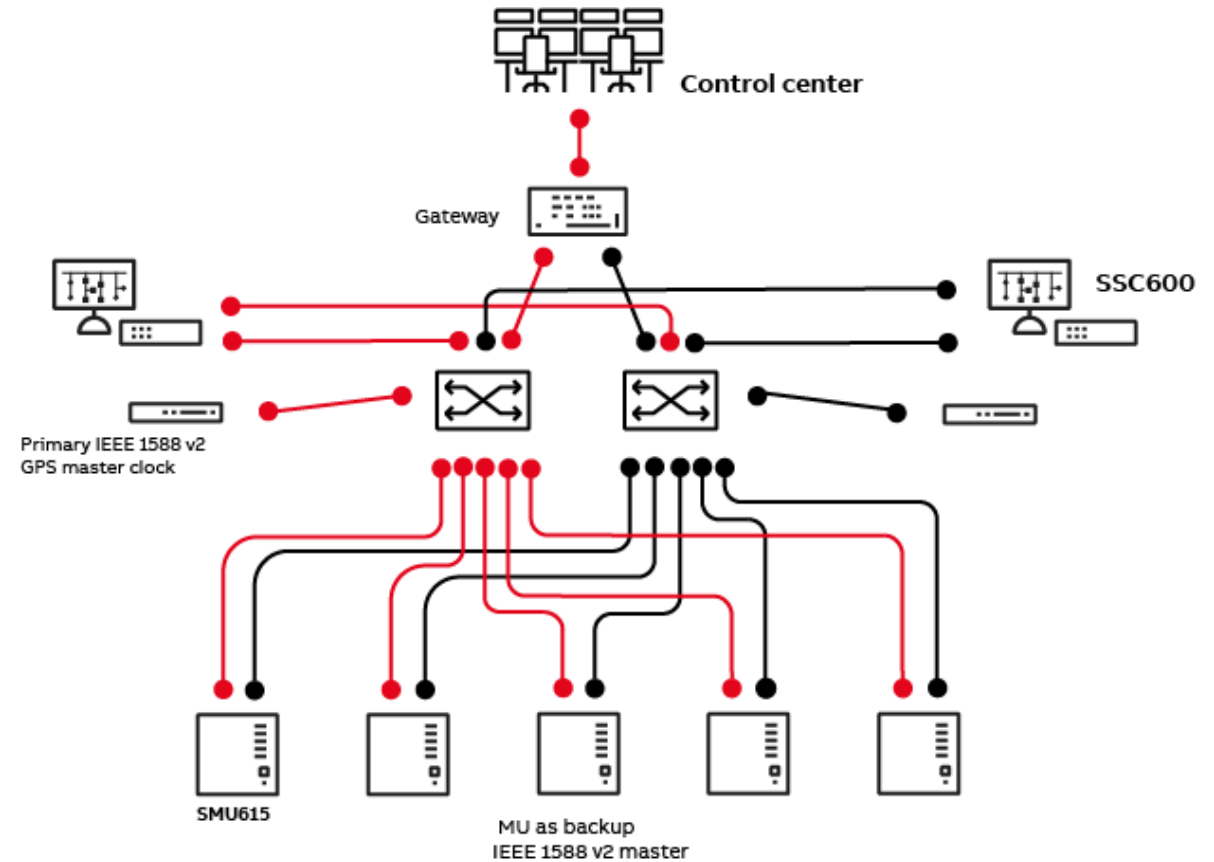Solution built with **MUs utilized in every bay/feeder** and redundancy

- **Redundant SSC600 units** with hot-hot protection standby and hot-standby control
- **Communication** based on IEC 61850 PRP – process and station bus
- **Time synchronization** via the IEEE 1588 v2 GPS master and backup time master from MU or secondary GPS master

Preferred **new installation use case** (all new equipment installed) – where redundant centralized functionality is required

System visualization using SSC600 and its WHMI

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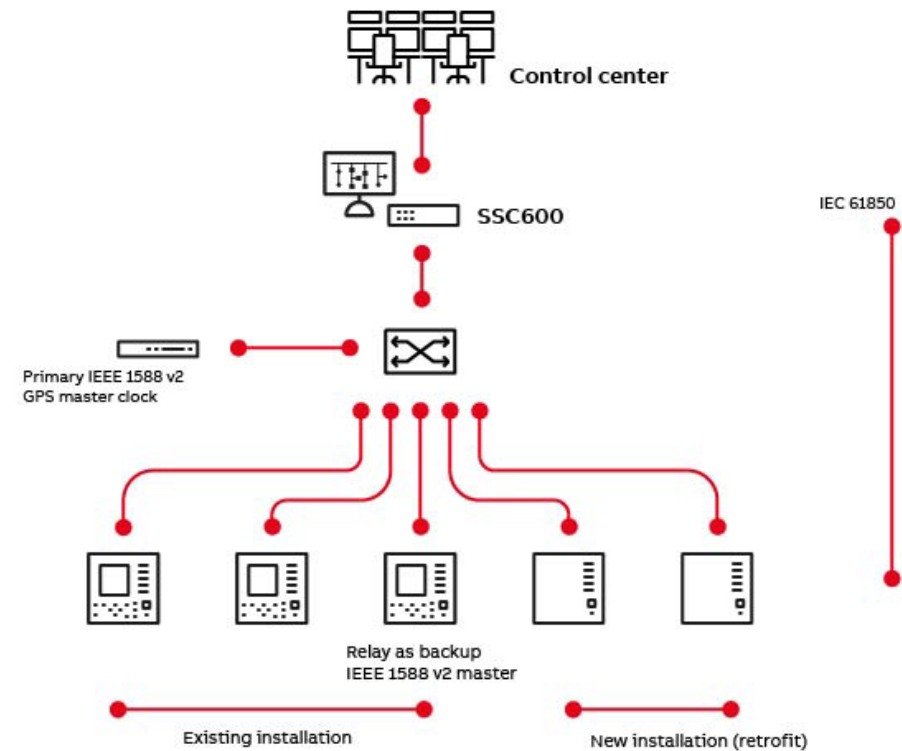
Direct communication to the control center possible with IEC 61850 or IEC 60870-5-104, without an external gateway in between

Control center

Gateway

SSC600

Primary IEEE 1588 v2
GPS master clock

SMU615

MU as backup
IEEE 1588 v2 master

ABB

Solution examples
Integrated/Retrofit

- Solution consisting of a **mixture of protection relay(s) with MU functionality and MUs** 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 using SSC600 and its WHMI**
- **Time synchronization via the IEEE 1588 v2 GPS master**
- Any capable protection relay can serve as backup time master
- Direct communication to the control center possible with IEC 61850 or IEC 60870-5-104, without an external gateway in between

Control center

SSC600

IEC 61850

Primary IEEE 1588 v2
GPS master clock

Relay as backup
IEEE 1588 v2 master

Existing installation

New installation (retrofit)

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**Secure device
management**

Secure device management
State-of-the-art cyber security functionalities

Support for the evolving cyber security standards and regulations

Support for dedicated

- IEC 61850-9-2 LE process bus to a network interface

- Local interface for single line diagram

- Engineering interface with DHCP
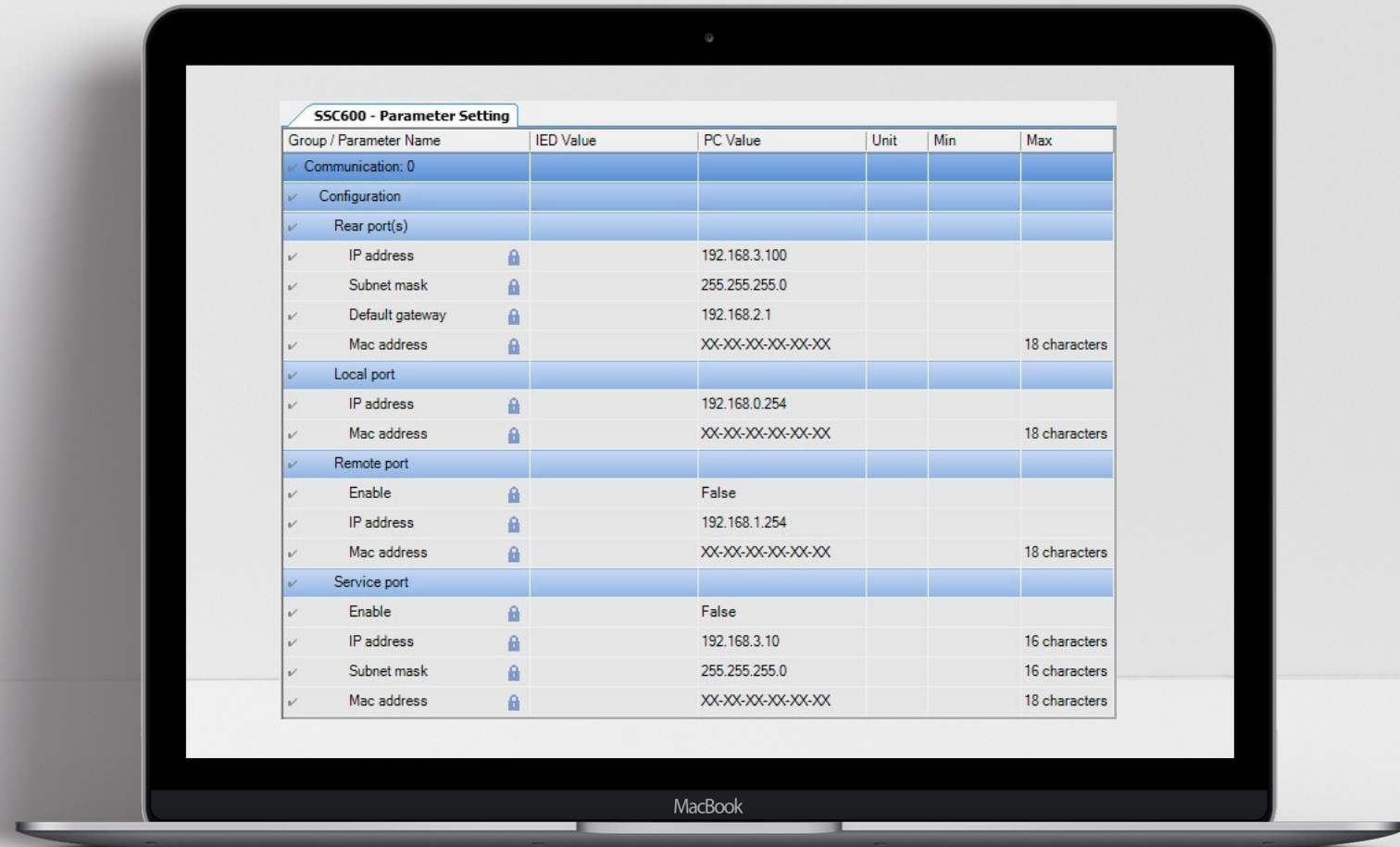
- Service interface with own IP address

Closable Ethernet interfaces

Secure engineering communication with HTTPS and FTPS

Role-based access control

Centralized security event logging with Syslog

Remote update with automatic status check and rollback

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(s)						
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

ADAM
Fleet management for SSC600

Easy-to-use, cybersecure and cloud-based, ADAM provides you with the full view of your devices, complete visibility of your data, and easy device management.

This digital solution is fully hosted in a cloud environment and secure communication from the site to the cloud can be managed, for example, with ABB's Arctic family of wireless communication products.

Learn more: ADAM product page
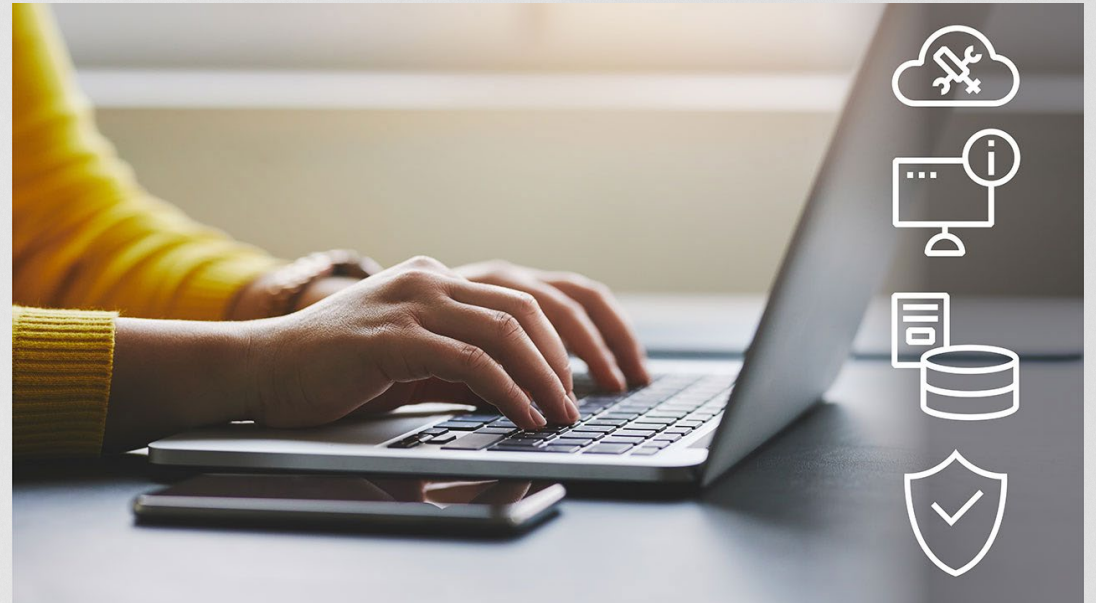
Ordering and modification

SSC600 device ordering and modification
Defining the variant for ordering

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

Ordering SSC600

- Select the amount of protected units (10-30 bays)
- Select the required software applications (feeder, motor, transformer)
- Select special protection
- Select the communication protocol
- Select the required HW options (power supply and communication)

Ordering ABB Mus or relays with MU capabilities

- Similar selection based on required hardware and software options

For ordering and configuring, use the same ABB Relays-Online as for other medium-voltage protection devices: https://relays.protection-control.abb/

SSC600 SW ordering and modification
Defining the variant for ordering

Purchase the hardware of your choice and order only SSC600 software:

Before you order

- Go to ABB Relays-Online and download SSC600 SW
- Install SSC600 SW on your chosen hardware
- Open SSC600 SW WHMI and generate the license request file

Ordering SSC600 SW

- Go to ABB Relays-Online
- Select the amount of protected units (10-30 bays)
- Select the required software applications (feeder, motor, transformer)
- Select special protection
- Select communication protocol
- Import the license request file to complete the purchase

Ordering ABB MUs or relays with MU capabilities

- Similar selection based on required hardware and software options

For ordering and configuring, use the same **ABB Relays-Online** as for other medium-voltage protection devices: https://relays.protection-control.abb/

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.
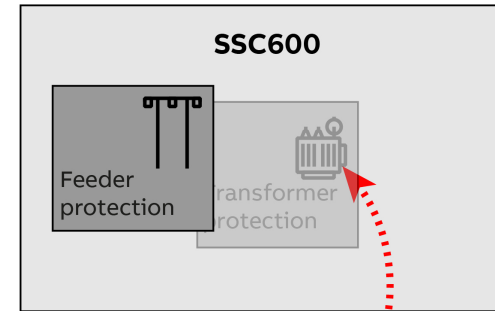
Application

- Adding optional application package(s)
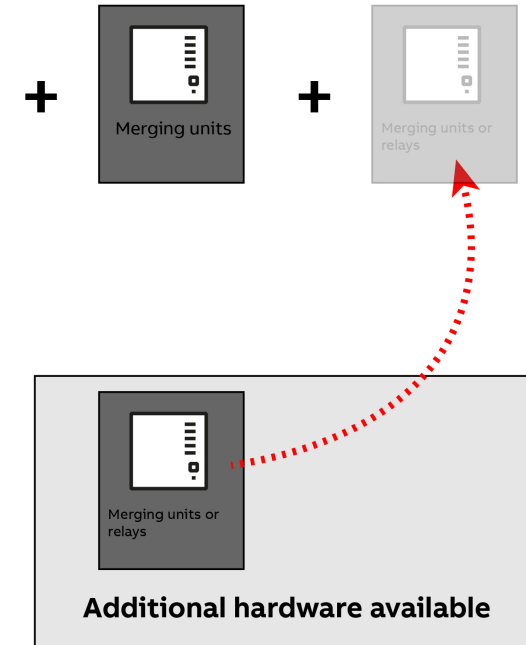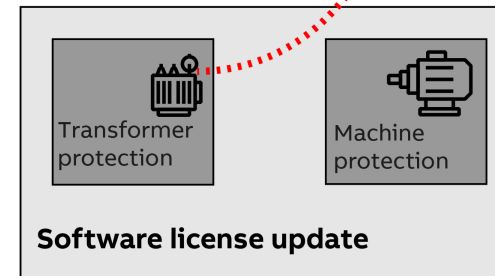- Updating and upgrading of protection functionality

Hardware

- Adding additional SSC600 or MU

The same order options as when ordering a new product are available for Modification Sales.

Existing device variant

SSC600

Feeder protection

Transformer protection

\+ Merging units \+ Merging units or relays

Requested modification

Transformer protection

Machine protection

Software license update

Merging units or relays

Additional hardware available
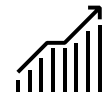
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Software maintenance agreement

Software maintenance agreement
Elevate product flexibility to a new level

With software products changes in the related IT environment might introduce more frequent changes

SSC600 SW includes a software maintenance agreement (SMA)

- Get access to the latest features and functionalities with feature pack upgrades
- Ensure long lifetime of your software product
- Information about software updates is available via ABB's online services

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Summary

Summary
## Complete application coverage for optimal cost-effectiveness

SSC600 introduces a revolutionary way of approaching protection and control in distribution networks

SSC600 offers unique benefits compared to traditional protection and control relays

- Wider application range
- Easy life cycle management
- Station-wide process visibility
- Can be installed on hardware of your choice

Centralized Protection and Control (CPC) based on international standards
(IEC 61850) ensures system compatibility
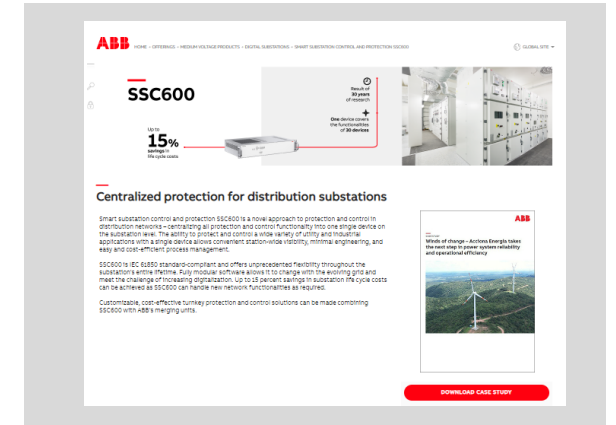
More information and material

Visit SSC600 campaign page

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