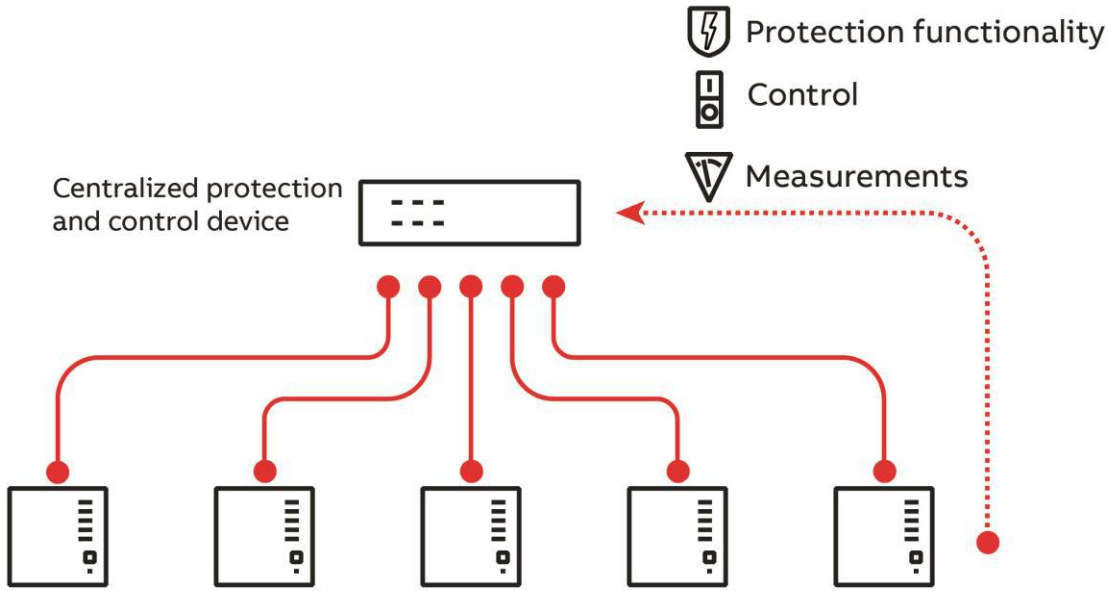


ABB

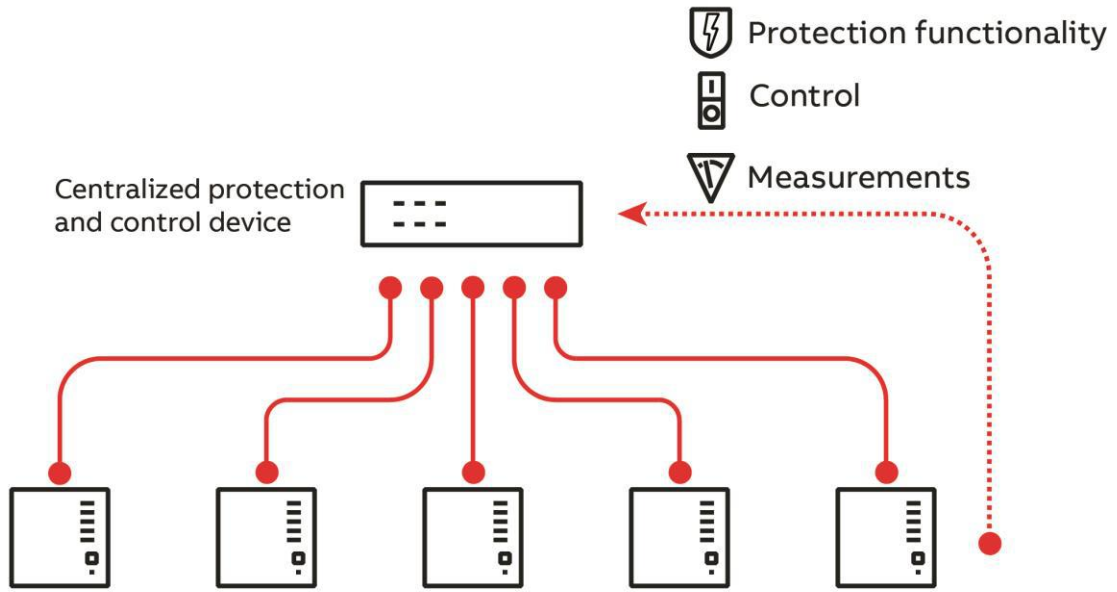
New Concept in Centralized Protection and Control for Distribution Substations

Centralized Protection and Control for Distribution Substations

What is ”centralized” protection?

Centralized protection in a nutshell

- Protection and control functionality centralized in one device in the substation
- Centralized access to control and monitoring functionality via a single human-machine interface (HMI)
- Customization and flexibility with application packages
- For both utility and industrial applications

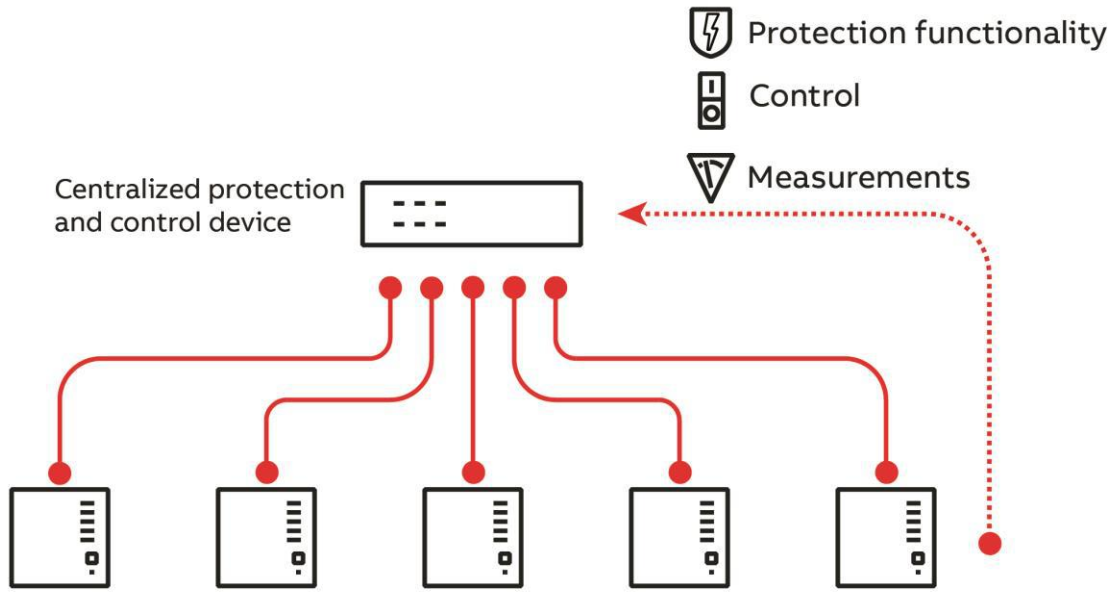


Centralized Protection and Control for Distribution Substations

What is ”centralized” protection?

Merging units

- Data collection by so called “merging units”
- Distributing analog and digital information to a central computer
- The central computer handles the protection functions
- Control commands, trip- and status signals distributed back to the merging unit

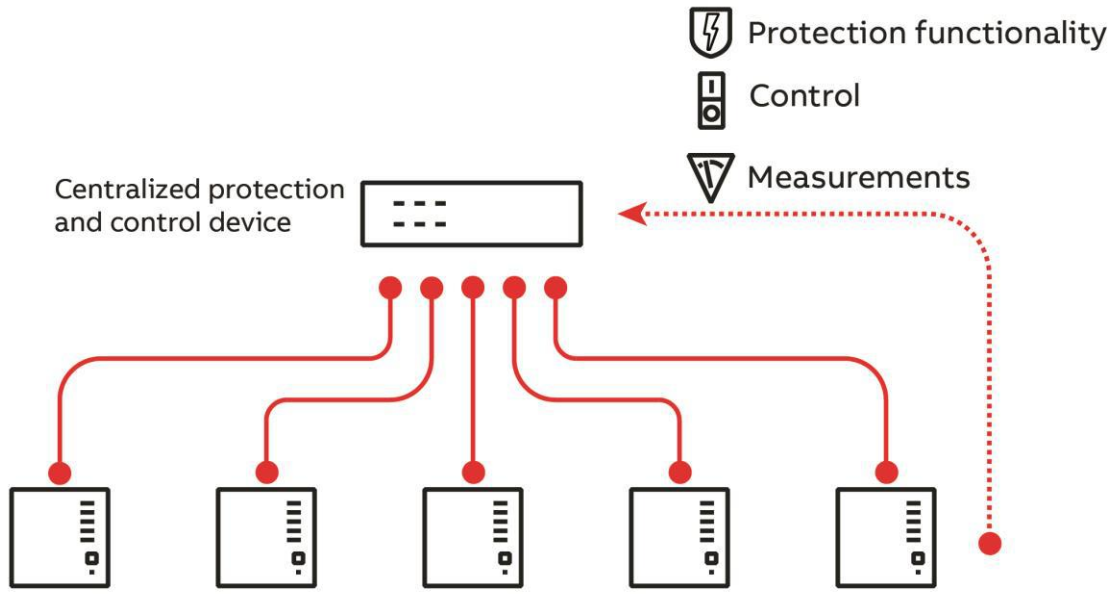


Centralized Protection and Control for Distribution Substations

Benefits

Centralized protection in a nutshell

- Removes most of the inter-panel hardwiring
- High speed bay-to-bay communication for interlocking and inter-tripping
- All based on standardized communication with IEC61850
- No proprietary protocols or solutions



Centralized Protection and Control for Distribution Substations

Standardized solution by IEC61850

Future proof

- Interoperability
  - The ability of IEDs from one or several manufacturers to exchange information
- Long term stability
  - The standard is future proof and able to follow the progress in communication technology and evolving system requirements

Centralized Protection and Control for Distribution Substations

Standardized solution by IEC61850

IEC61850

- Internationally accepted protocol standard for communication networks and systems in substations
- Not only a communication protocol but it also affects system building, tools and configuration
- The main difference to previous communication standards is the standardized substation modeling
- Defines a set of communication services for substation communication

Centralized Protection and Control for Distribution Substations

Standardized solution by IEC61850

IEC61850

Uses Ethernet for data transmission

- Fast, reliable and cost effective
- Supports evolving technology
- Parallel connections and services between IEDs and clients

XML-based substation configuration language (SCL) allows substation configurations transmitted between tools and vendors in a standardized way

Conformance tests by independent laboratories

Centralized Protection and Control for Distribution Substations
Standard Principles

Substation Communication Services

Client-server communication

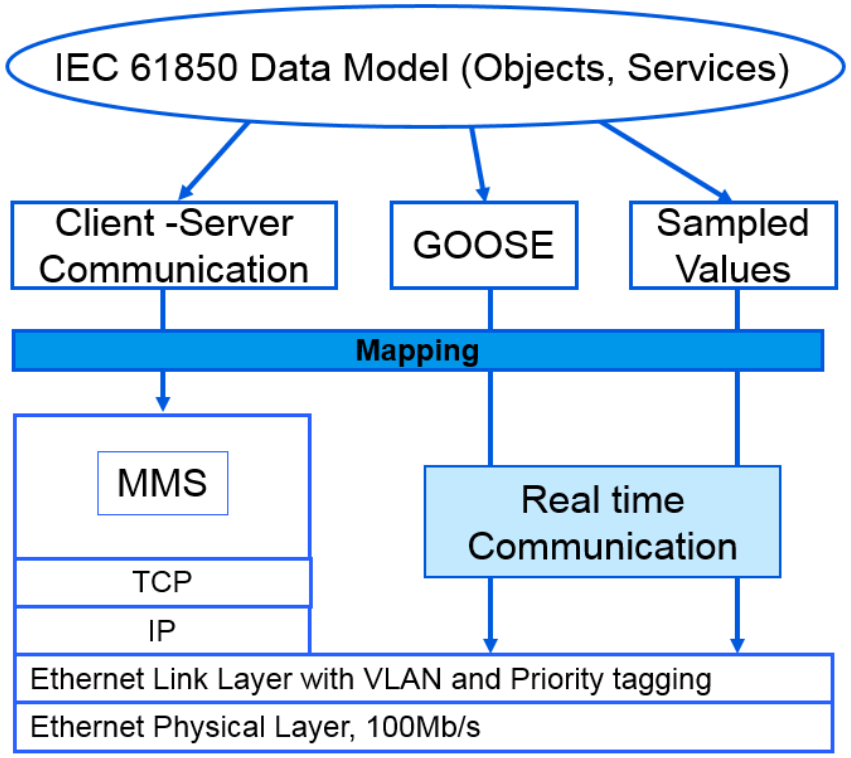
- Event reporting
- Measurements
- Fault recordings

Real time horizontal bay-to-bay communication (GOOSE)

- Communication between the central computer and merging units
- Substitution for interpanel wiring
- Interlocking, intertripping and blocking

Sampled Values (process bus)

- Real time current and voltage measurement for protection distributed over the communication network

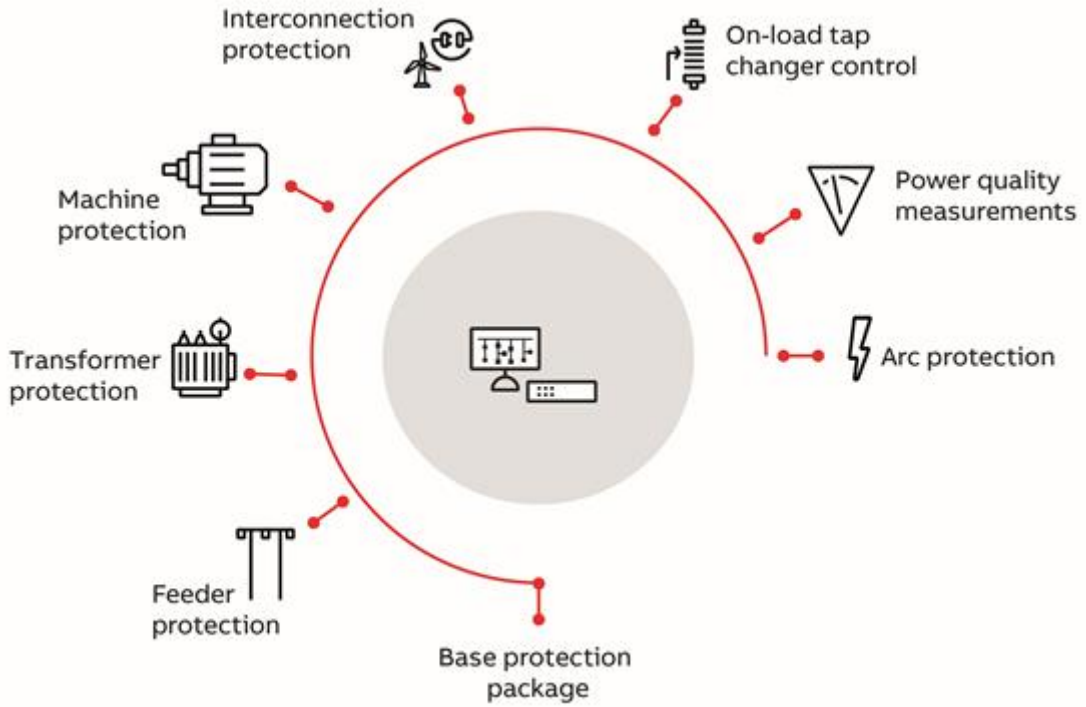


Centralized Protection and Control for Distribution Substations

Values

Flexibility

- The protection functionality in the centralized solution provides flexibility to build a optimal power distribution protection scheme – reducing complexity
- The freedom to adapt to changing network environments
- The freedom to extend and upgrade the solution at any time with minimised engineering
- Minimised process downtime during maintenance work due to ease of device replacement and minimised engineering of the solution
- Two partitions on the centralized protection computer to allow fallback if an upgrade or configuration fails

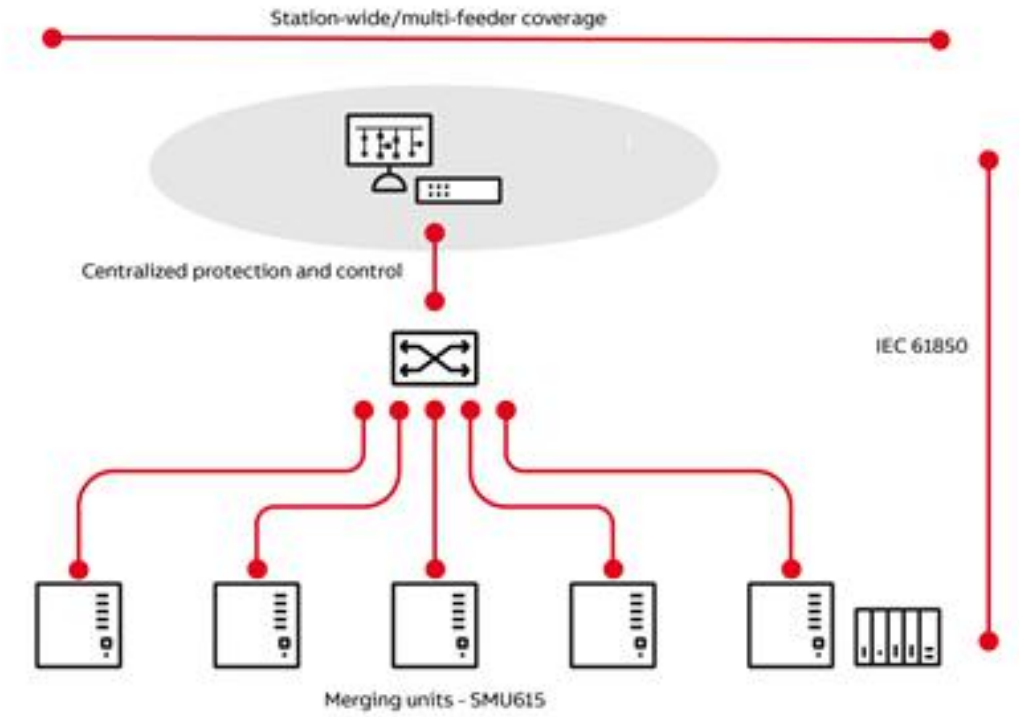


Centralized Protection and Control for Distribution Substations

Values

Ease of use

- 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
- Reduced complexity of the network due to all protection and control functionality in one centralized device in the substation
- Easy to add or replace a device with minimised engineering of the solution

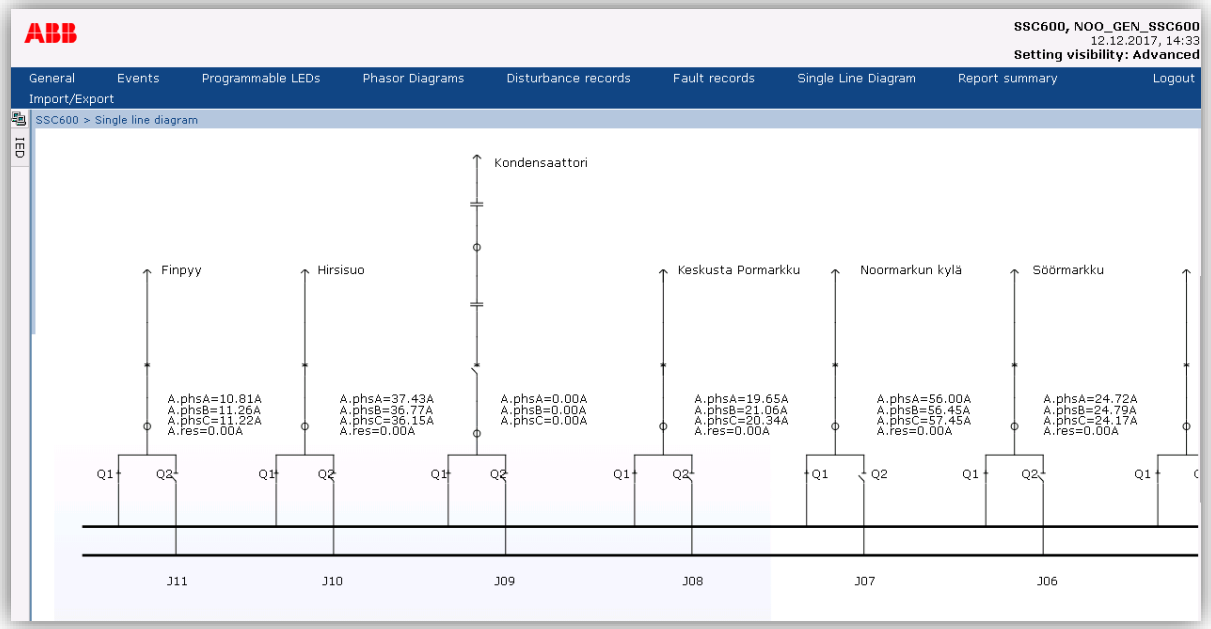


Centralized Protection and Control for Distribution Substations

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

Substation level Single Line Diagram (SLD)

- Visibility and control of the whole substation via the Single Line Diagram
- Secure management of control access
  - Control is only allowed from dedicated local interfaces
  - From other interfaces only monitoring is allowed
  - Secure encrypted connection (TLS)



Centralized Protection and Control for Distribution Substations

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

Substation level alarm handling

– Virtual alarm LEDs for all kinds of subsation level alarms

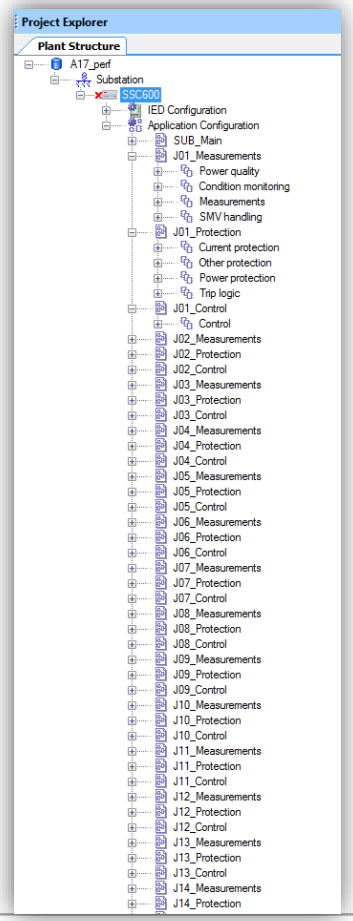
– Centralized alarm center for the substation

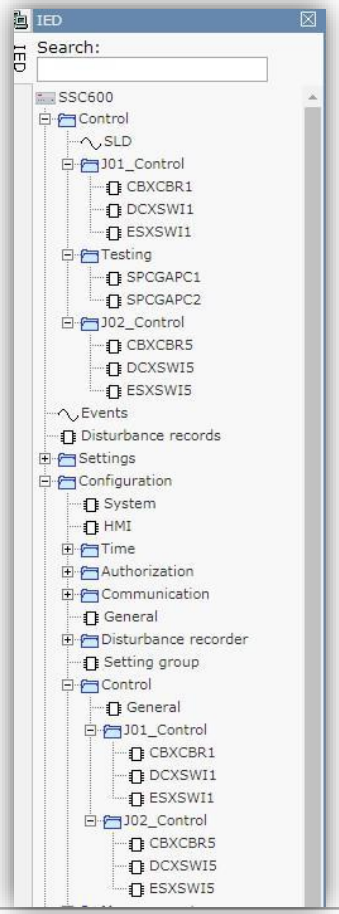
Centralized Protection and Control for Distribution Substations

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

Settings management in WHMI

- Protection parameter settings through the Web based HMI
- 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





Centralized Protection and Control for Distribution Substations

Station level disturbance recorder

Full visibility for network faults

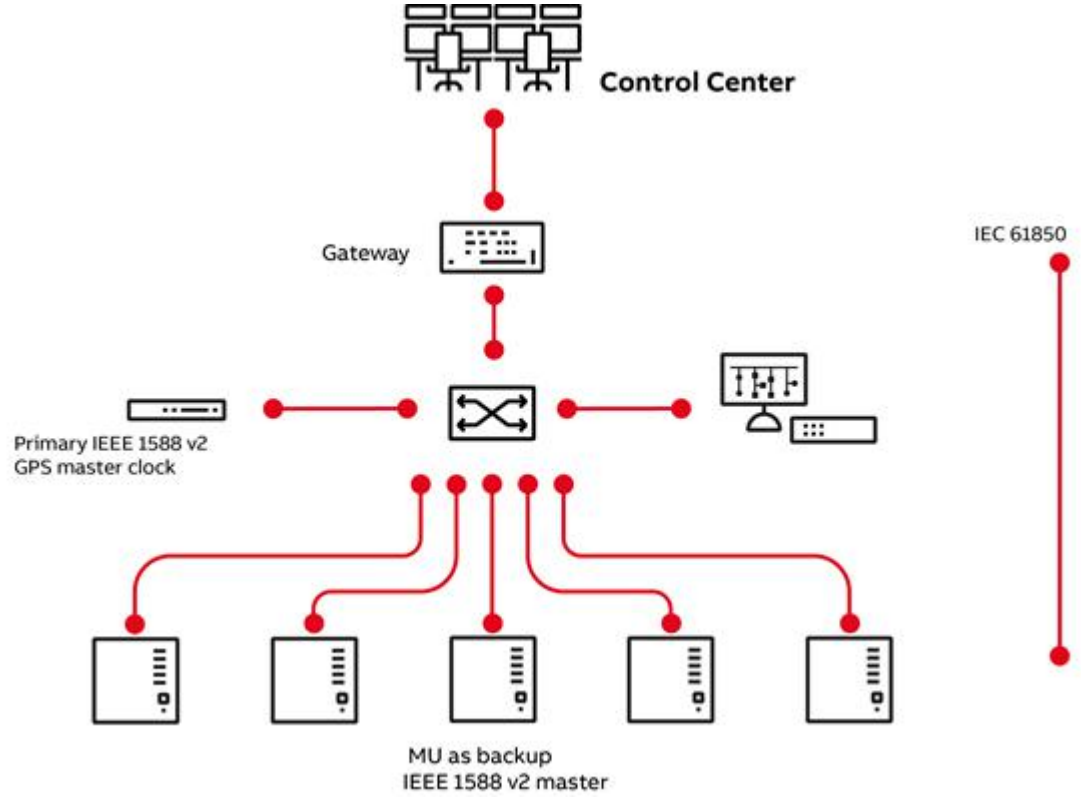
- Recordings of all received measurement streams with 4 kHz sampling rate
- Recordings of both phase quantities and phase-to-phase quantities
- Recording of binary signals
- Stored in COMTRADE format

Centralized Protection and Control for Distribution Substations

Example solution

Centralized with single computer

- Solution consisting of a system built with merging units utilized in every bay/feeder
- A single IEC 61850 network for process and station bus
- System visualization via WebHMI
- Time synchronization via IEEE1588v2 GPS master
- Any smart merging unit can serve as backup time master
- Substation gateway/RTU doubles up as HMI



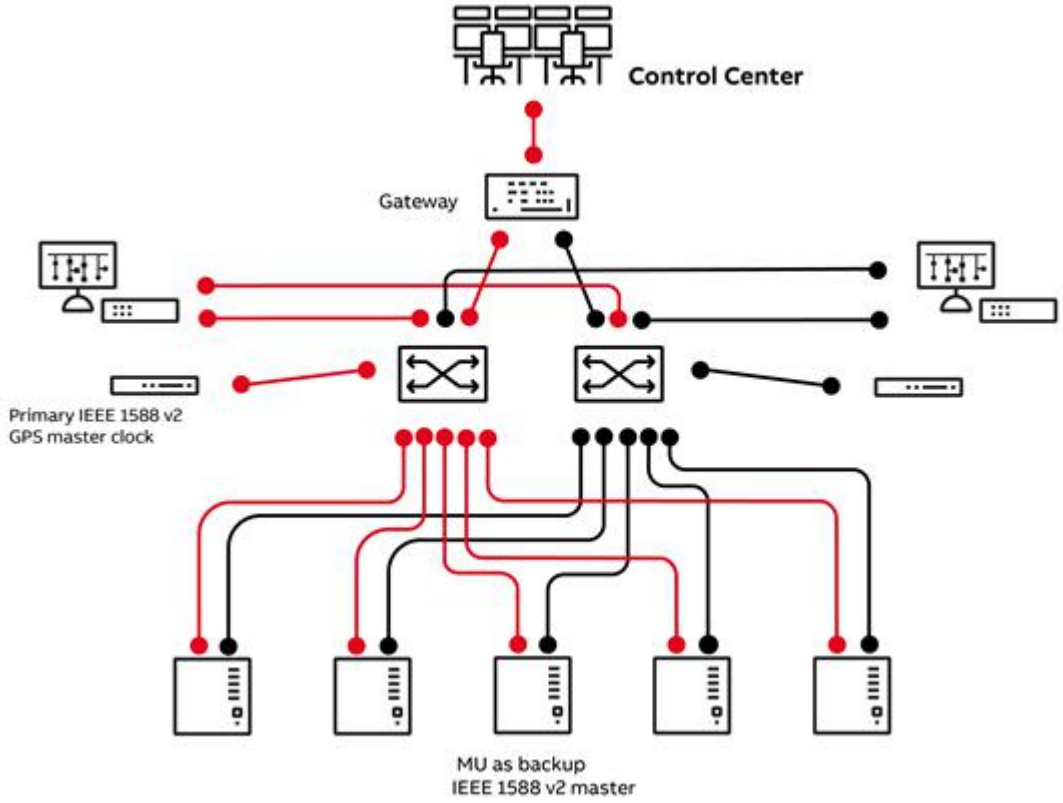
Centralized Protection and Control for Distribution Substations

Example solution

Centralized protection with redundancy

- Solution built with merging units utilized in every bay/feeder and redundancy with regards to
  - Redundant central units with hot-hot protection and control
  - Communication based on IEC 61850 PRP
  - Time synchronization with IEEE1588v2 GPS master,

  merging unit as backup time master or even a secondary GPS master
- Substation gateway/RTU doubles up as HMI

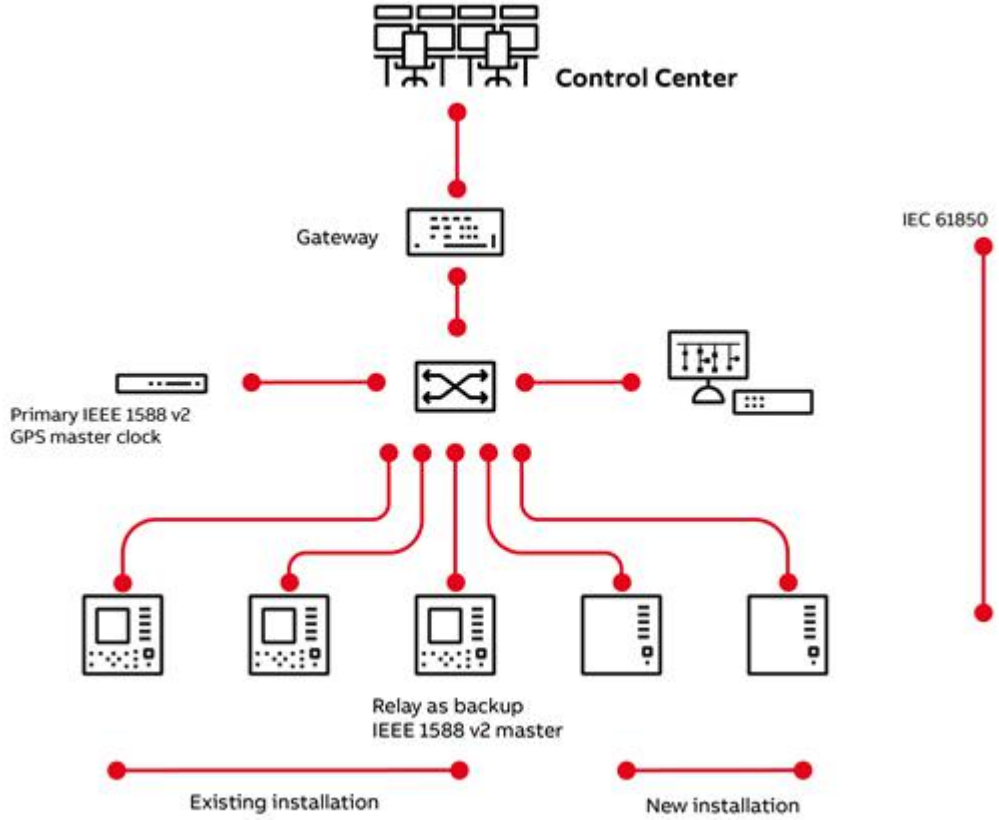


Centralized Protection and Control for Distribution Substations

Example solution

Retrofit

- Solution consisting of a mixture of protection relay(s) with merging unit functionality and merging units utilized in every bay/feeder
- A single IEC 61850 network for process and station bus
- Time synchronization via IEEE1588v2 GPS master
- Any capable protection relay can serve as backup time master
- Substation gateway/RTU doubles up as HMI

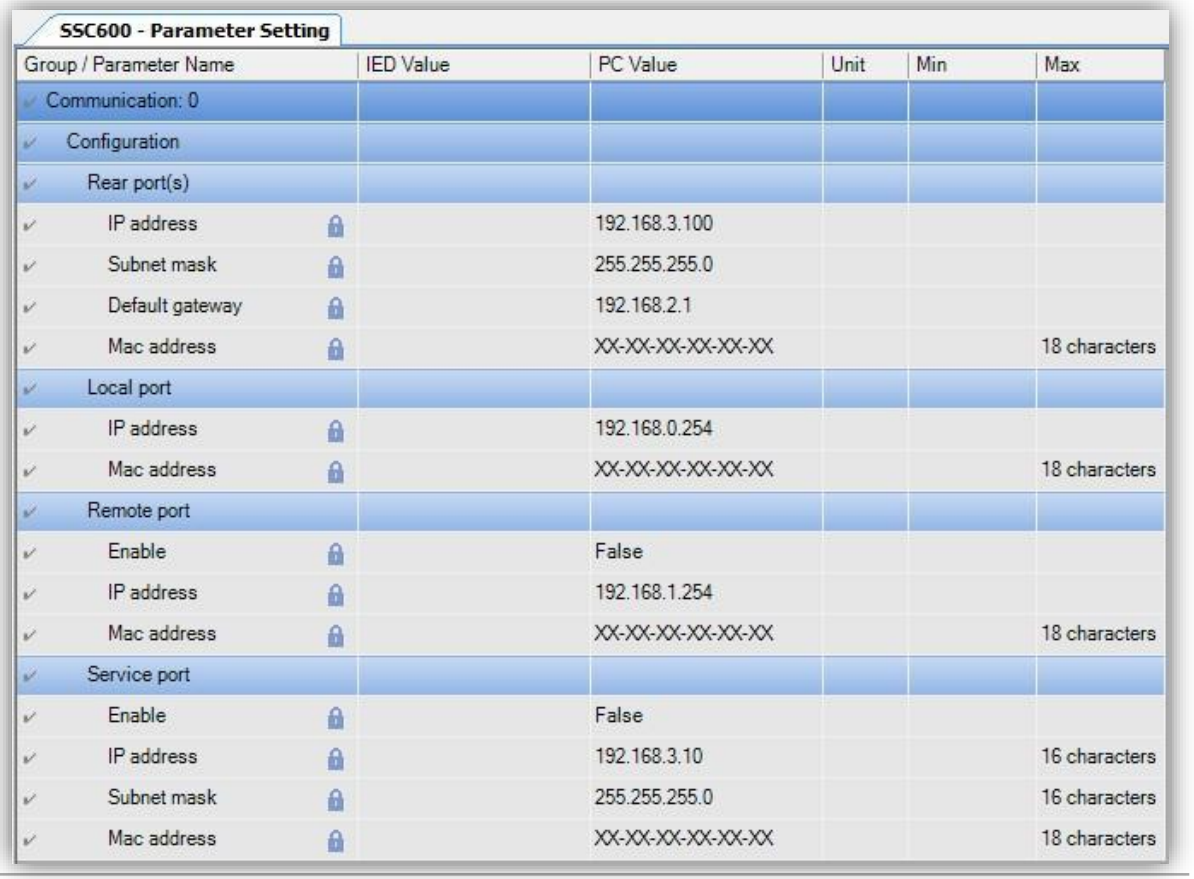


Centralized Protection and Control for Distribution Substations

Multiple interfaces for different purposes

Improved security via different interfaces

- Support 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



SSC600 - Parameter Setting

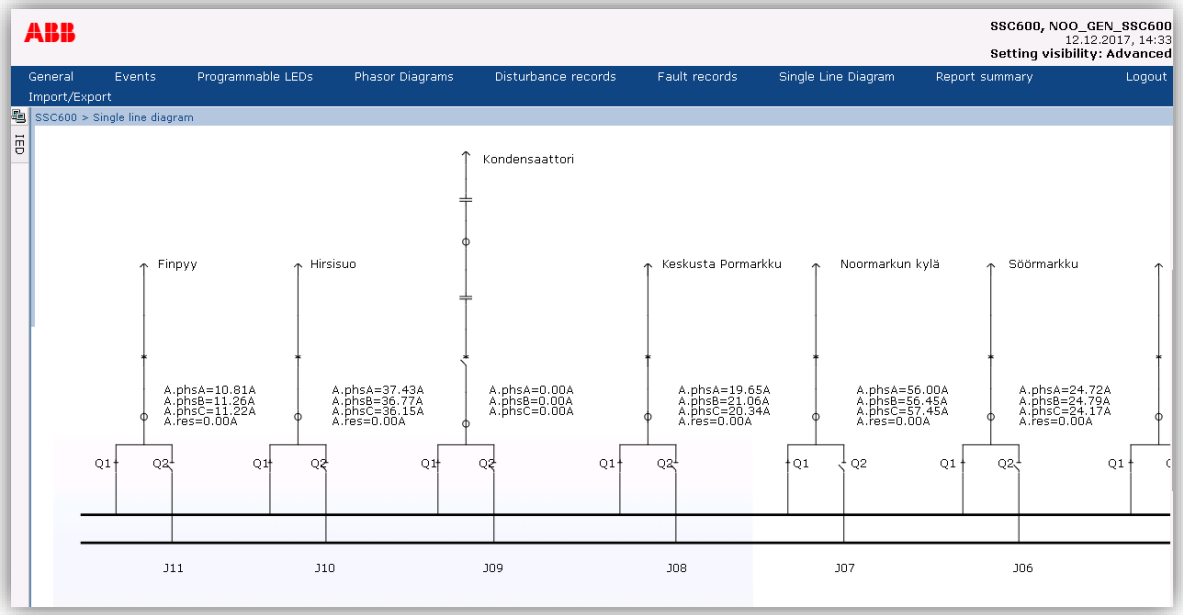
Group / Parameter Name	IED Value	PC Value	Unit	Min	Max
Communication: 0					
Configuration					
Rear port(s)					
IP address		192.168.3.100			
Subnet mask		255.255.255.0			
Default gateway		192.168.2.1			
Mac address		XX-XX-XX-XX-XX-XX			18 characters
Local port					
IP address		192.168.0.254			
Mac 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

Centralized Protection and Control for Distribution Substations

Extended remote update support

Remote update with automatic check and roll-back

- 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

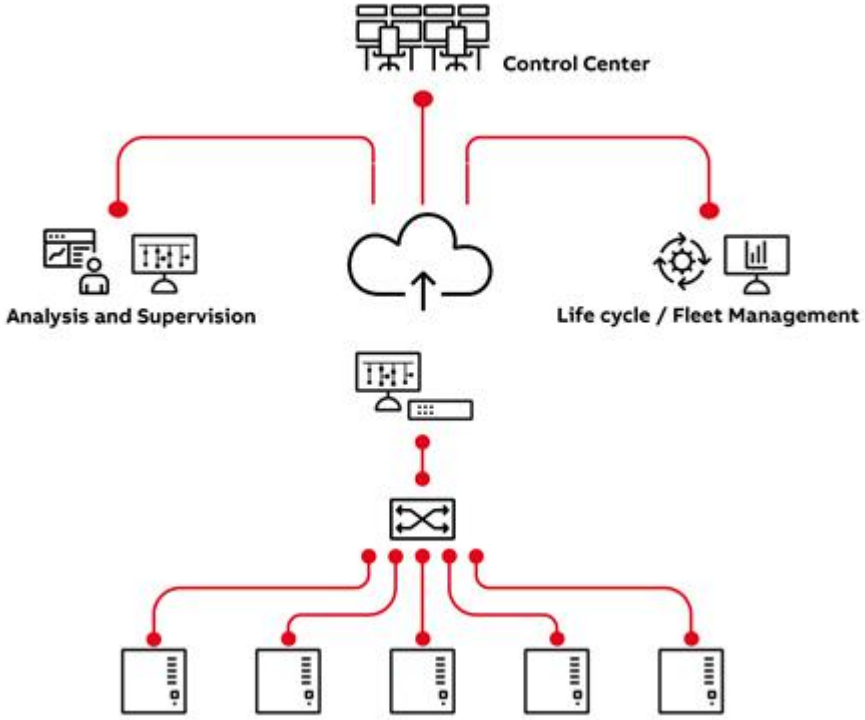


Centralized Protection and Control for Distribution Substations

Asset management

Supervision and diagostics

- 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 upgrades
  - Remote diagnostics
  - Asset management
  - Cyber security updates
  - Firmware patch updates
  - Configuration backup

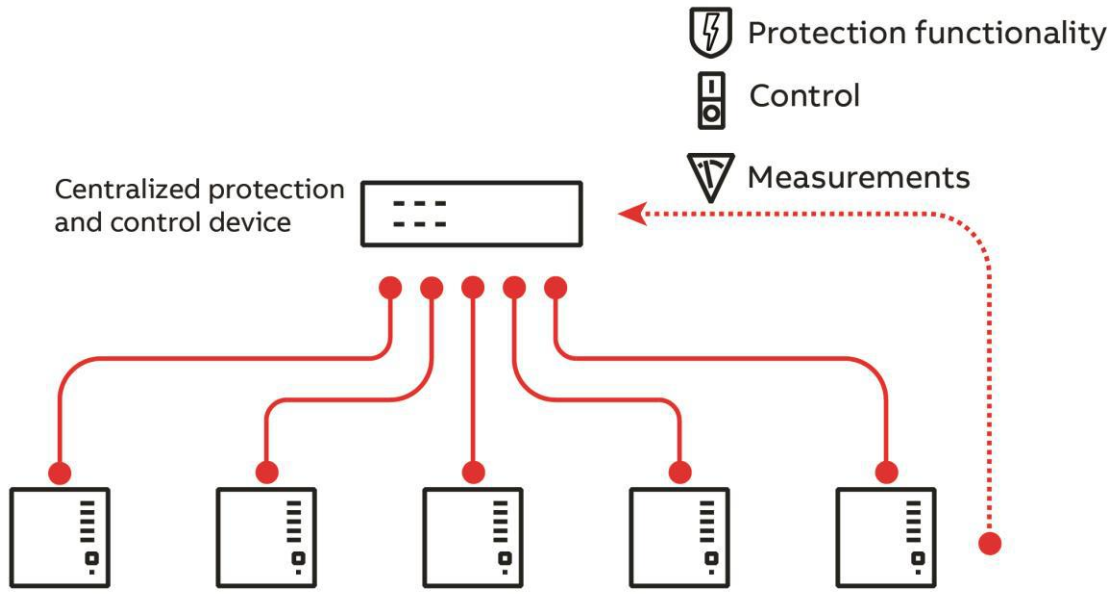


Centralized Protection and Control for Distribution Substations

Summary

Centralized protection in a nutshell

- Protection and control functionality centralized in one device in the substation
- Centralized access to control and monitoring
- Fully based on IEC61850
- No proprietary protocols or solutions
- Secure encrypted connections




ABB