



DISTRIBUTION SOLUTIONS

Centralized protection and control for distribution substations

How does it compare to a conventional P&C system approach?

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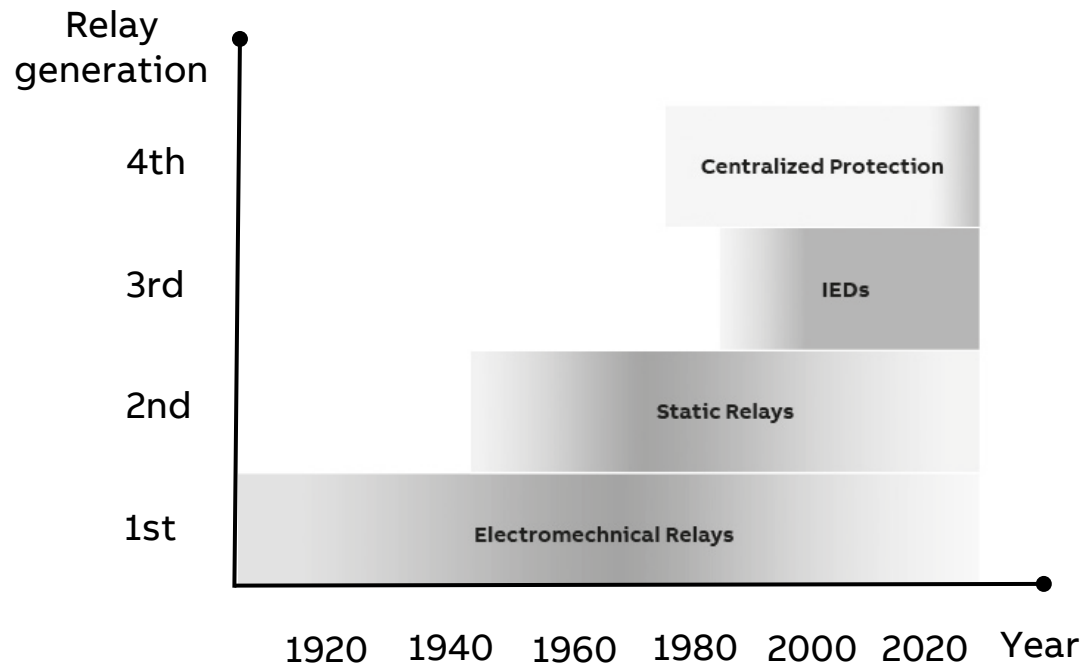
History of protection and control

Evolution of technology - from electromechanical to static relays to microprocessor-based intelligent electronic devices (IED) and centralized protection and control (CPC).

Centralized protection has been researched and developed for decades. First centralized solutions from ABB were taken into use in the 1990s.

Centralized protection and control for MV substations researched for more than 15 years and first commercially available product launched in 2019.

Standards and technology have now reached the maturity level for commercially viable centralized protection and control solutions.

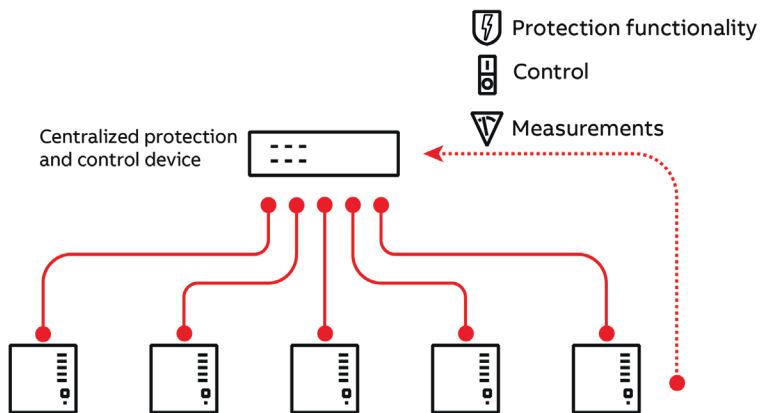


Legend

Low density

High density

CPC system concept and components



SSC600

Based on the IEC 61850 global standard for power system applications

Move protection and control from multiple feeder level devices to a single central processing unit



Merging units (MU)

Act as the interface between the instrument transformers and SSC600

Option of using an intelligent merging unit - a protection relay capable of performing MU functionality

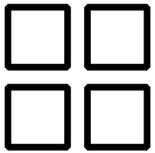


Additional technologies

Substation time synchronization according to IEEE 1588 v2 and IEC 61850-9-3

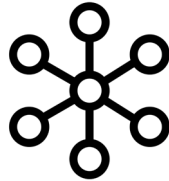
Redundant communication as per IEC 62439-3 (Parallel Redundancy Protocol)

Asset simplification



Conventional approach

- One or more relay per feeder based on application
 - Example – Transformer, feeder, bus, etc.
- Wrong order code selection has significant impact on project cost and the execution time
- Spares maintained for each relay type



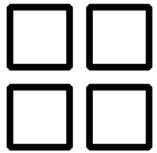
CPC approach

- Eliminates the need of one relay per feeder per application
- All feeders have same type of merging units
- Protection functions no longer dependent on the hardware
- Only two types of hardware for the entire substation – SSC600 and the MU



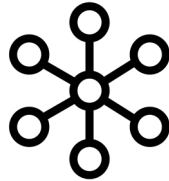
Simplicity –
with a CPC approach
there is only two types
of hardware for the
entire substation

System engineering



Conventional approach

- Each protection relay is configured individually for protection elements, settings, GOOSE messaging, and interlocking schemes
- Alarms, events and DRs are distributed, not time synced in many real substations
- Reconfiguration of protection and control requires extensive re-engineering effort



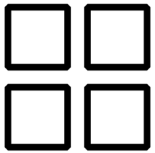
CPC approach

- All protection elements, settings and control for the whole substation at a single point - about 30% reduction in engineering time
- Centralized alarms, events and disturbance recording facility
- Reconfiguration of protection and control easily performed to adapt to changing substation / grid requirements



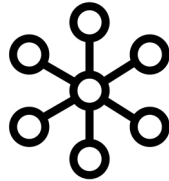
Cost savings –
with a CPC approach
engineering time is
reduced by about 30%

Cost of installation



Conventional approach

- Huge amount of wiring between relays for example interlockings
- Each device needs its own bus voltage measurement
- Dedicated hardware (protection devices, CTs, and wiring) for busbar and arc flash protection
- Additional substation level devices (communication gateway, HMI, disturbance recorder)



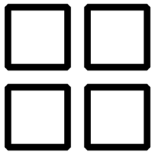
CPC approach

- All inter-bay dependencies inside the CPC device
- Need only one bus voltage measurement which is shared via Sampled Value (SV) to all feeders
- Add bus protection (bus-differential, arc flash) by just adding the software application package
- Station-level functionality in CPC device (station HMI, station-wide disturbance recording, communication gateway, etc.)



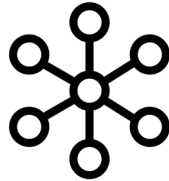
Cost savings –
a CPC approach is
more cost-efficient

Maintenance



Conventional approach

- Firmware updates performed on individual relays
- Dedicated devices for different purposes makes asset handling/management difficult



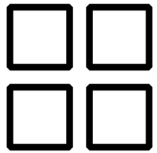
CPC approach

- Updates mainly needed for the SSC600
- Limited amount of device types



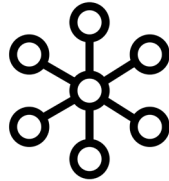
Speed –
with a CPC approach
doing updates is fast
and easy

Changing requirements



Conventional approach

- Addition of new protection applications require additional relay(s) and wiring
- Several hours of shut down required for hardware modification and wiring



CPC approach

- Additions of new applications with software application packages only



Flexibility –
with a CPC approach
adding new applications
is fast and easy

Example: 69/13.8kV substation

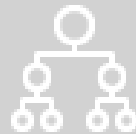
In this section you can find illustrative examples of typical conventional set-ups compared to a CPC approach.



Conventional vs. Centralized
protection and control



Typical utility one-line

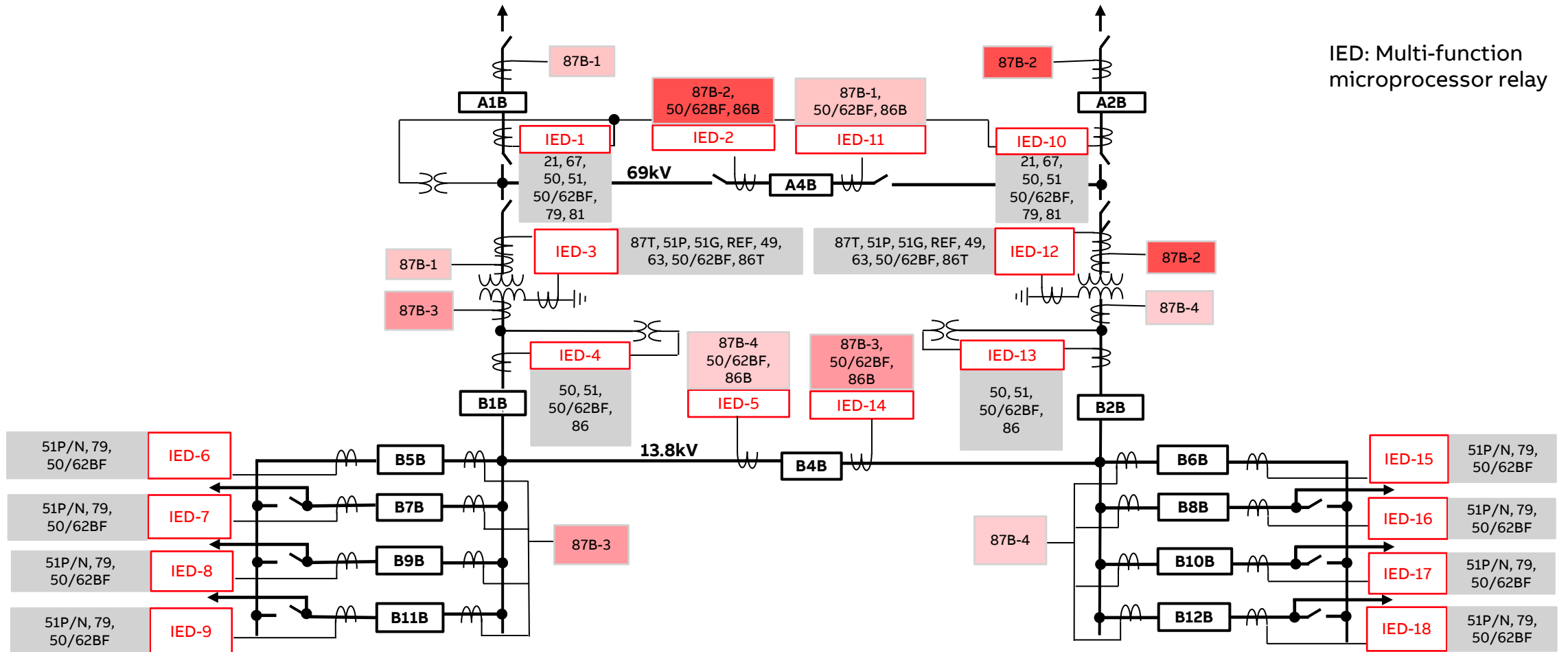


Typical merging unit
arrangement

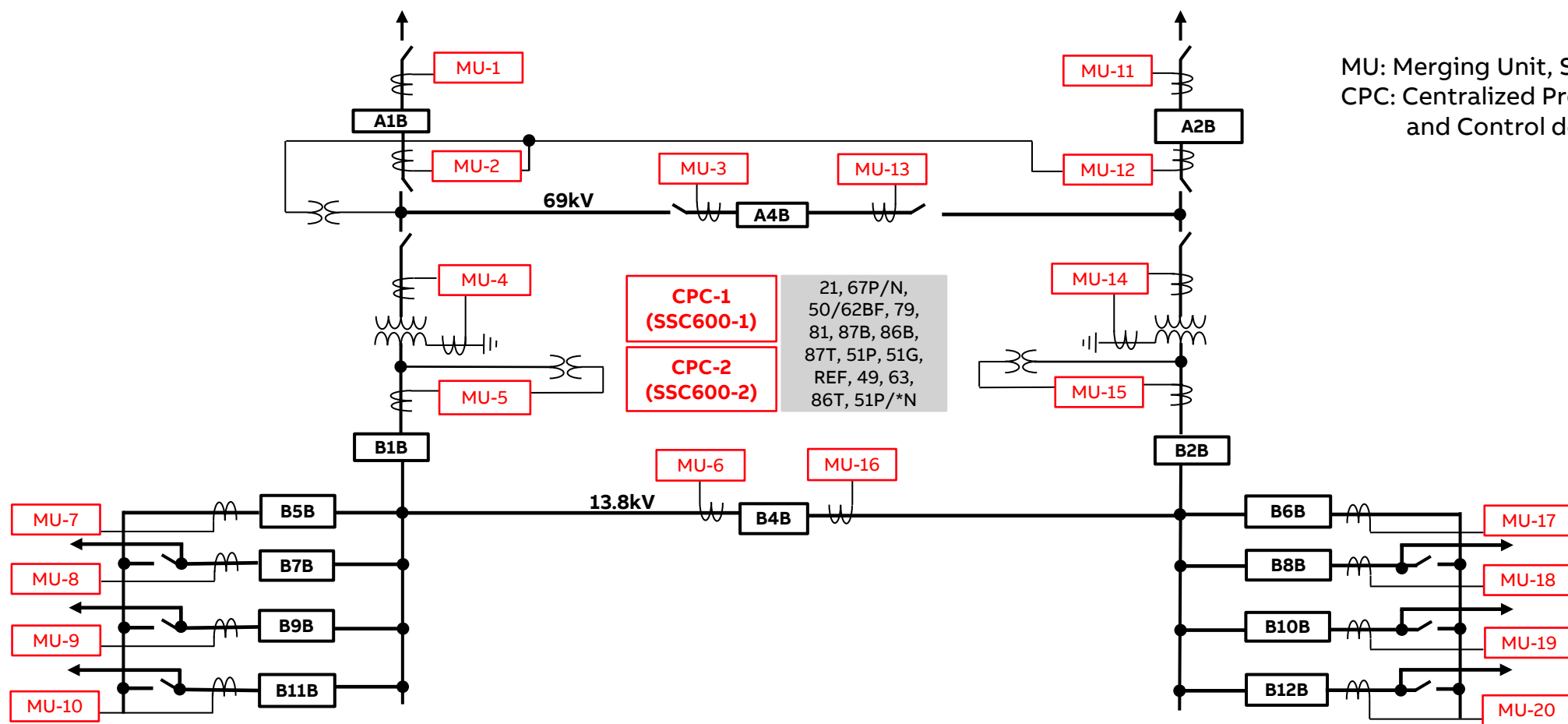


Zones of protection

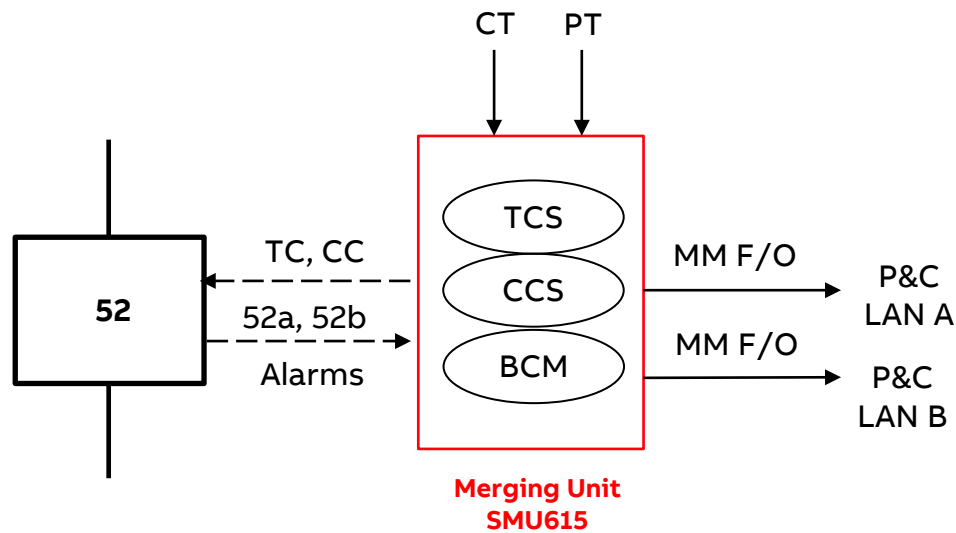
Typical 69/13.8kV substation - Conventional P&C approach



Typical 69/13.8kV substation - CPC solution



Merging unit – Typical connections



52 = Circuit breaker (CB)

BCM: Breaker condition monitoring

CC: CB Close coil

CCS= Current circuit supervision

CT: Current Transformer

MM F/O: Multi-mode fiber optic

LAN: Local Area Network

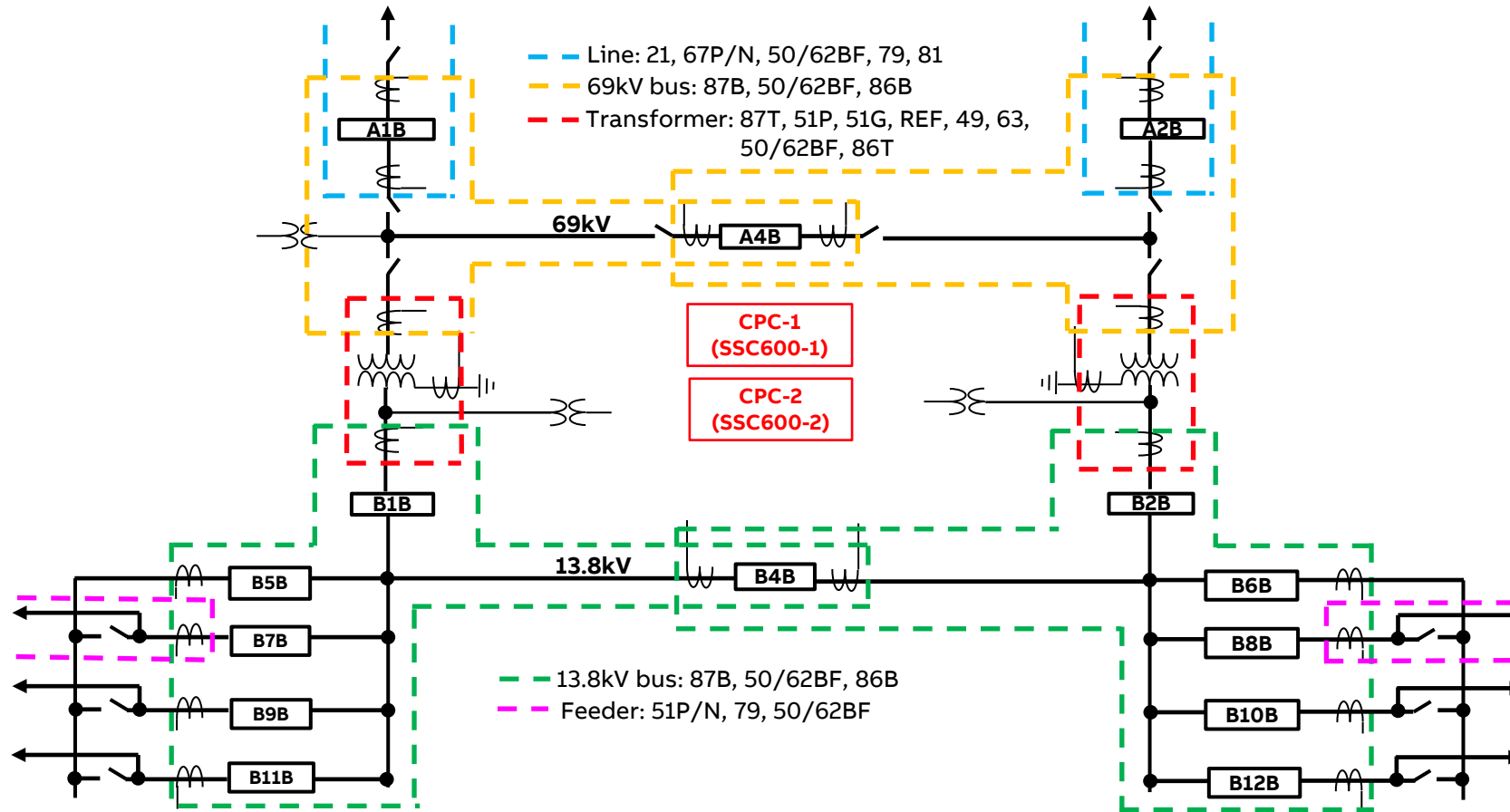
P&C: Protection and Control

PT: Potential Transformer

TC: CB Trip coil

TCS: Trip coil supervision

Zones of protection covered by SSC600 – CPC solution



SSC600



Smart Substation Control and Protection SSC600 is a novel approach to protection and control in distribution networks – centralizing all protection and control functionality into one single device on the substation level.

The ability to protect and control a wide variety of utility and industrial applications with a single device allows convenient station-wide visibility, minimal engineering, and easy and cost-efficient process management.

SSC600 is IEC 61850 standard-compliant and offers unprecedented flexibility throughout the substation's entire lifetime. Fully modular software allows it to change with the evolving grid and meet the challenge of increasing digitalization.

Up to 15% savings in substation life cycle costs can be achieved as SSC600 can handle new network functionalities as needed.

Learn more about
centralized protection
and control



White papers:

[Performance analysis of centralized protection and control solution for a distribution substation](#)

[Centralized protection and control – Enhancing reliability, availability, flexibility and improving operating cost efficiency of distribution substations](#)



Web pages:

[Centralized protection campaign page](#)
[SSC600 product page](#)



Videos:

[Centralized protection YouTube playlist](#)

ABB