



4CAE000558; WEBINAR, 2018-02-15

# Enabling digital substations

SAM600-IO switchgear control unit

Thomas Werner, Global Product Manager

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# Agenda

Digital substation and customer benefits

SAM600

- Features and benefits
- Application examples

Product support

References

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# Agenda

## Digital substation and customer benefits

### SAM600

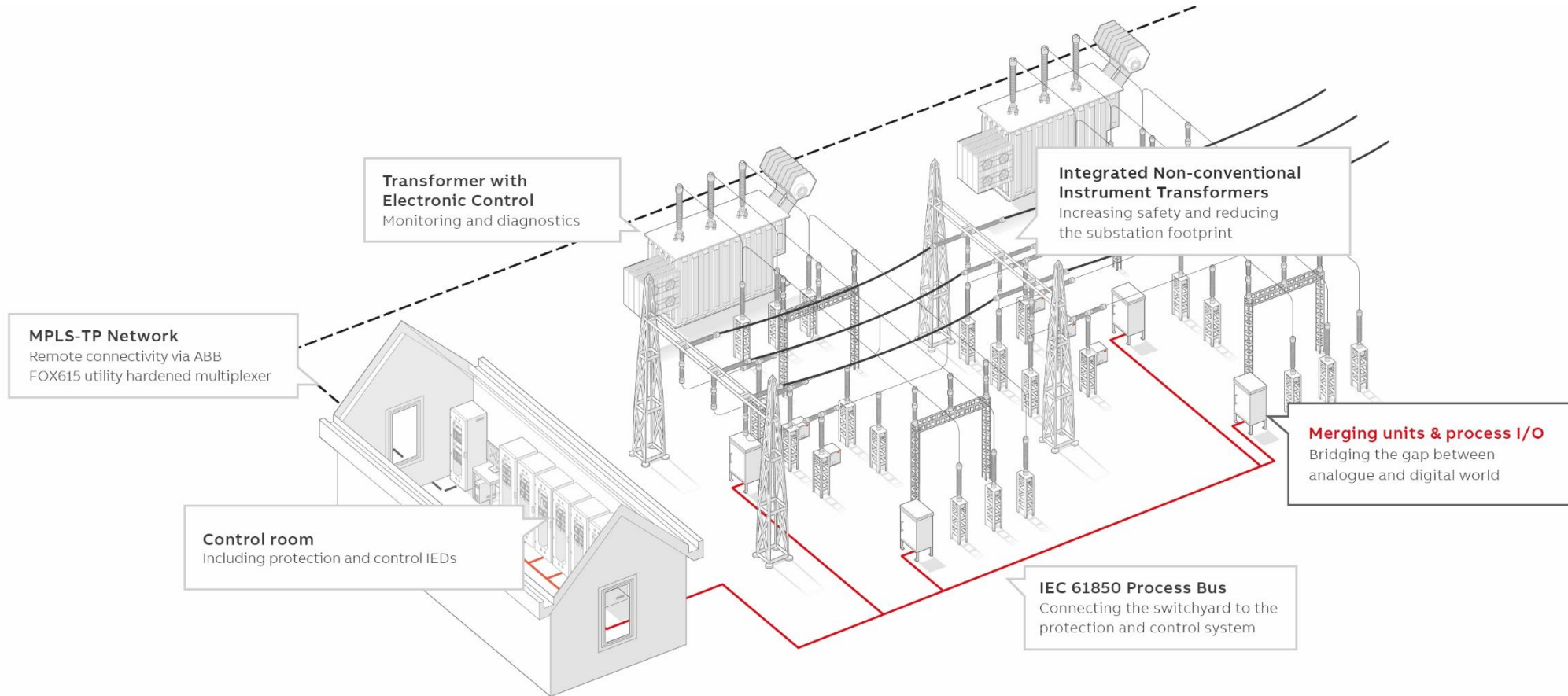
- Features and benefits
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# Digital substation concept

Minimize or eliminate copper wiring in the switchyard



# Digital substation and IEC 61850

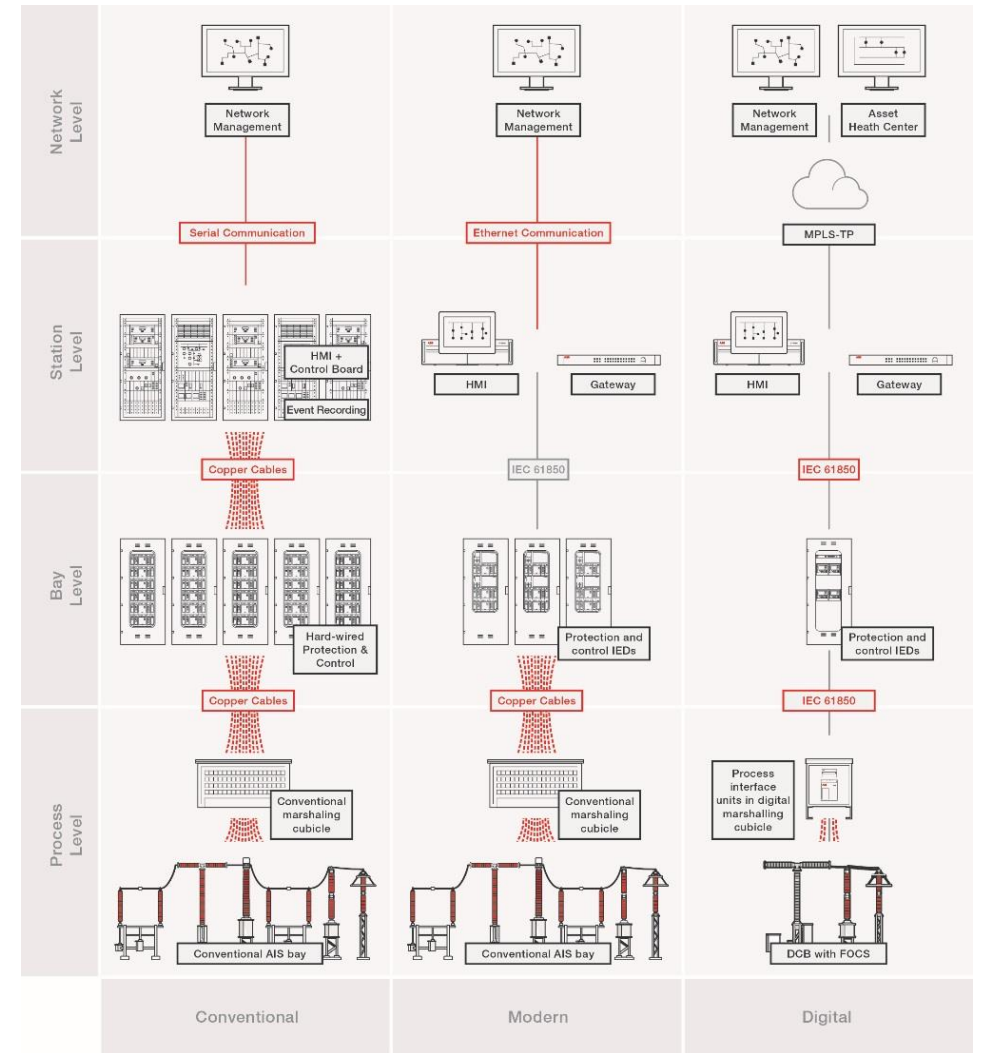
## Today and tomorrow

### Digital substation and IEC 61850 today

- Interface to field
  - Hardwired point to point connections between primary and all secondary equipment
- IEC 61850 Station Bus
  - Replace wiring and legacy protocols between bays by digital communication

### Digital substation and IEC 61850 tomorrow

- All signals digital, station and process
- Analog, status and commands
- Acquire once, distribute on a bus



# Opportunities

## Less space

### Space reduction

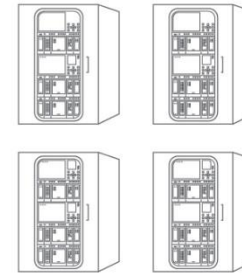
30 to 60% reduced space for protection and control panels

- Same number of IEDs require less space due to absence of conventional IOs
- Higher integration of control and protection functionality allows for further space reduction

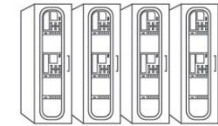
Reduction of switchyard footprint by up to 50%

- By using circuit breakers with integrated disconnecting functionality and optical current transformers

Conventional substation



Digital substation



Up to  
**60%**  
less space  
in the relay  
house

Up to  
**50%**  
reduction of  
space in the  
switchyard\*

\* Based on a typical conventional 400kV double busbar AIS substation compared to a modern variant using SAM600 process bus IO system and FOCS integrated in disconnecting circuit breakers.

# Opportunities

## Less installation and outage time

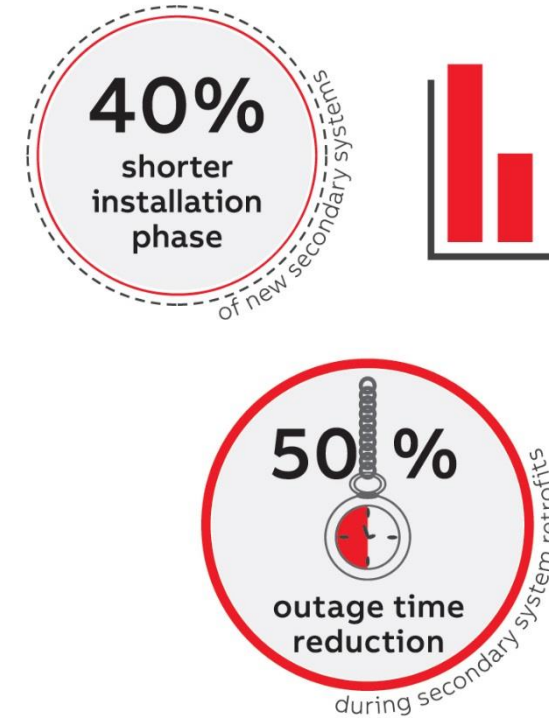
### Shorter installation, less outage

40% reduction of installation time for new protection and control systems.

- Fewer panels to install
- Fewer cables to be pulled, connected and tested

Reduction of feeder outage time by 40 to 50% during secondary system upgrades

- Full system test from process IO to protection, control and SCADA system off-site
- Installation of new FO based system while station is in service



# Opportunities

## Pre-tested building blocks and late project customization

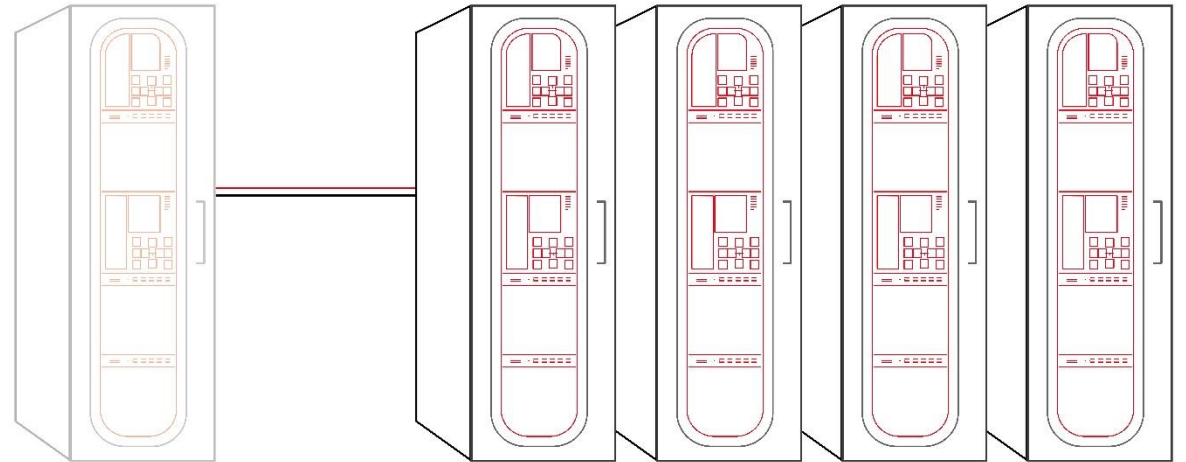
### Pre-testing and customization

#### Reduction in on-site testing

- Building blocks of pre-defined, pre-tested kiosks in the factory with process electronics

#### Late customization

- All communication is digital based on IEC 61850
- Now new or additional wiring as project changes require updated system and device configurations





# Opportunities

## Safety and maintenance

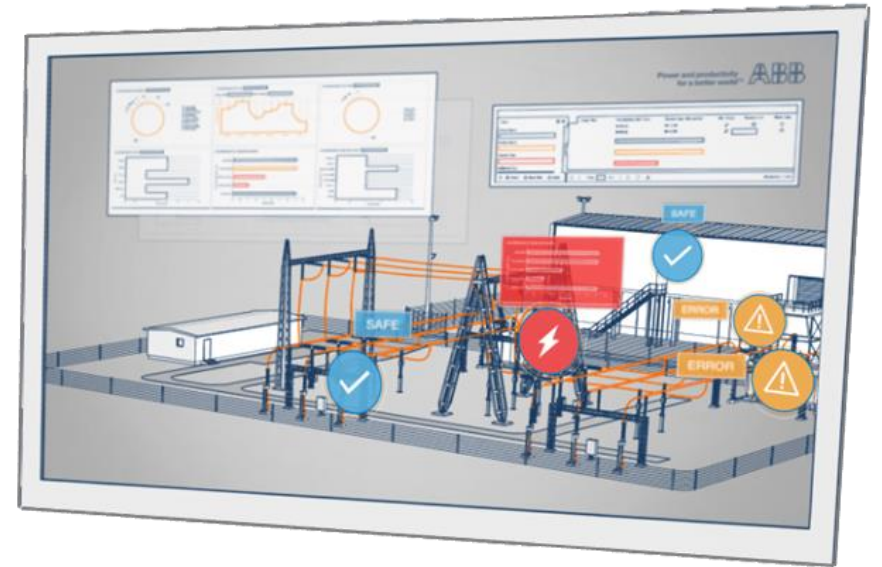
### Safety and maintenance

Digitizing all signals right at their source in the field

- Decreased risk of electrical hazards
- Maintenance of equipment in station panels without de-energizing bays

Cost Effective Maintenance

- Higher degree of supervision allows for more efficient planning of maintenance activities



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**SAM600**

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# ABBs portfolio for digital substation solutions

## Overview

### Station level

- SAS600 series of substation automation solutions with IEC 61850 station bus

### Bay level

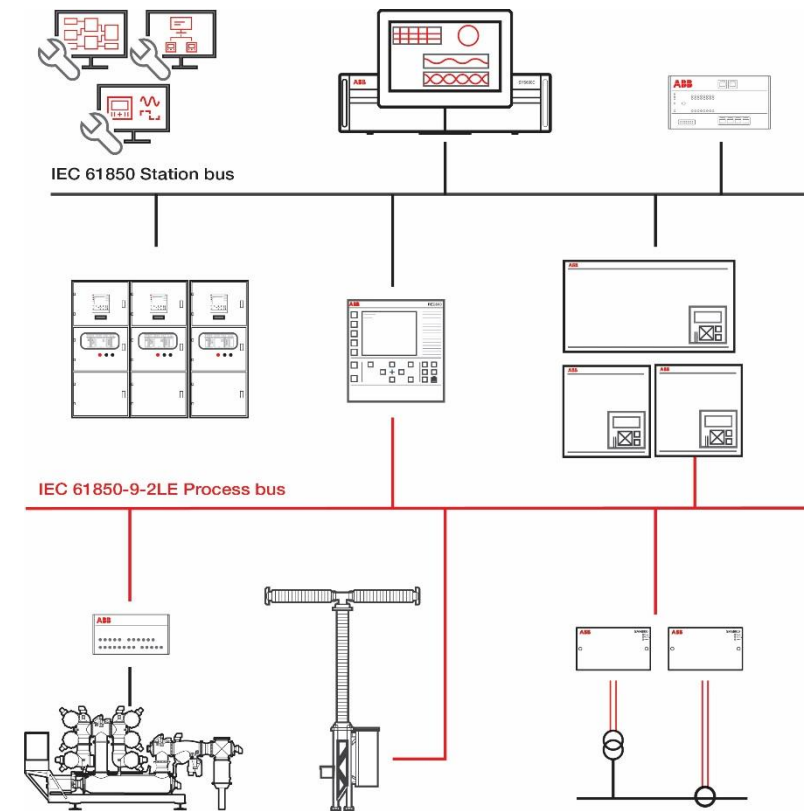
- Relion® 670 series control and protection IEDs
- Relion® REB500 busbar protection system
- UniGear Digital for MV applications
- IEC 61850 system engineering and testing tools: IET600, ITT600

### Process level – NCIT

- ABB NCITs for GIS, CP-MU merging unit for ELK-CP14 and ELK-CP3 (current and voltage)
- ABB LTB with integrated Fiber Optic Current Sensor FOCS-MU (current only)

### Process level – stand-alone merging units

- SAM600 modular process bus IO system



# SAM600 – ABB's process bus IO system

Digitizing primary signals made easy

## Process-close I/O system

For interfacing primary equipment to IEC 61850 process bus

- Connects to conventional current or voltage transformers
- Interfaces primary apparatus such as circuit breakers, disconnectors, earth switches and transformer tap changers
- Provides time synchronization (optional)
- Easily scales with the signals of the primary apparatus to be interfaced
- Ruggedized and optimized form factor for installation in cabinets close to the primary equipment
- Easy access to signals with front-facing terminals



# SAM600 – ABB's process bus IO system

Digitizing primary signals made easy

## Technical features – switchgear control unit

Binary IO interface for monitoring and control of switchgear

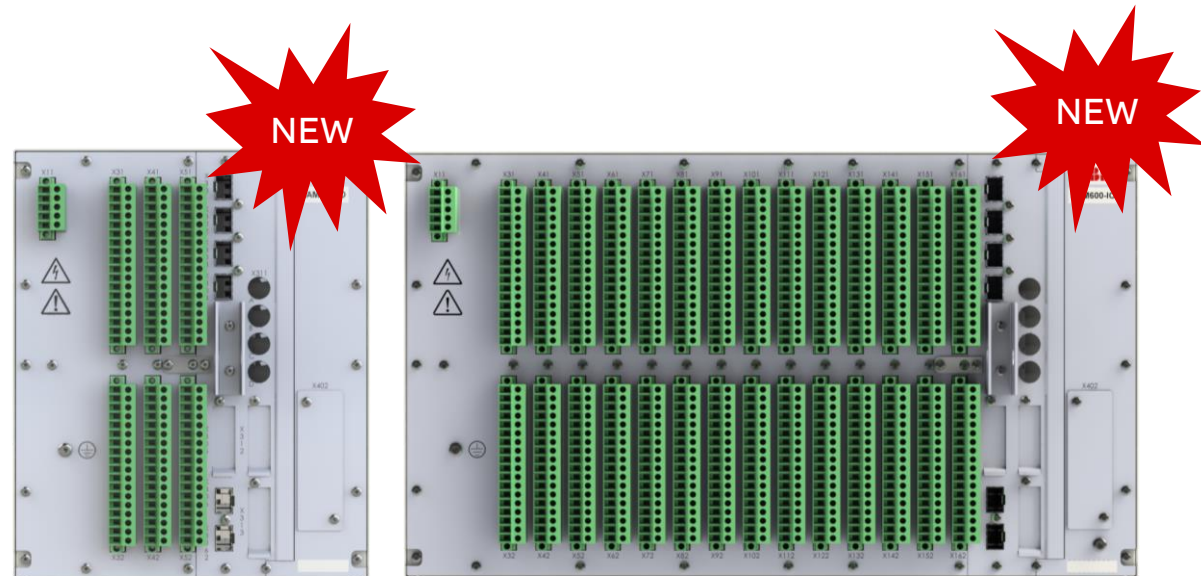
- 6U 1/1x19", 6U 1/2x19" form factors
- I/O integration and control of several switching devices in the same unit
- Supports cost savings by reduction of copper wire

Communication

- Up to 6 optical Ethernet ports supporting up to 3 redundant PRP/HSR access points
- Time synchronization via IEC/IEEE 61850-9-3
- IEC 61850-8-1 GOOSE messaging with low latency

Environmental

- Operating temp range: -40°C .. +70°C ambient for 16hrs
- Shock and endurance vibration Class 1

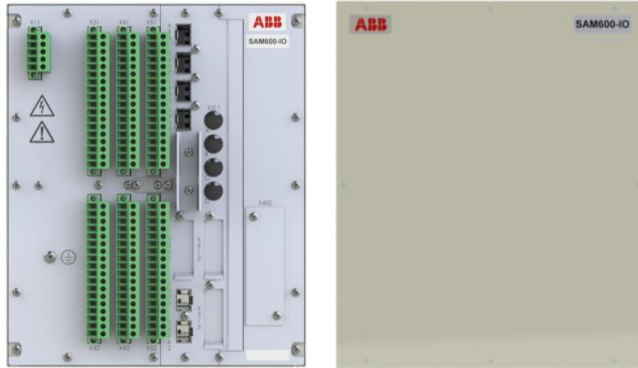


# SAM600-IO

## 1/2 6U 19" variant

Usage: Interface I/O of small feeder or single breaker

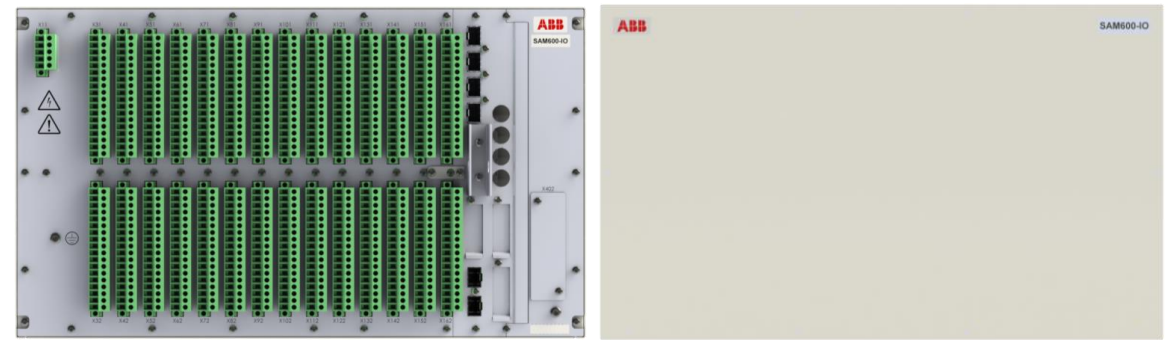
- 3 slots for BIM, BOM, SOM, IOM, MIM (out of H67 series)
- Standard 4 SFPs
- Cover for LHMI service kit connector



## 1/1 6U 19" variant

Usage: Interface I/O of large feeder (trafo) or backup for complete 1 1/2 BB diameter

- 14 slots for BIM, BOM, SOM, IOM, MIM (out of H67 series)
- Standard 4 SFPs
- Cover for LHMI service kit connector

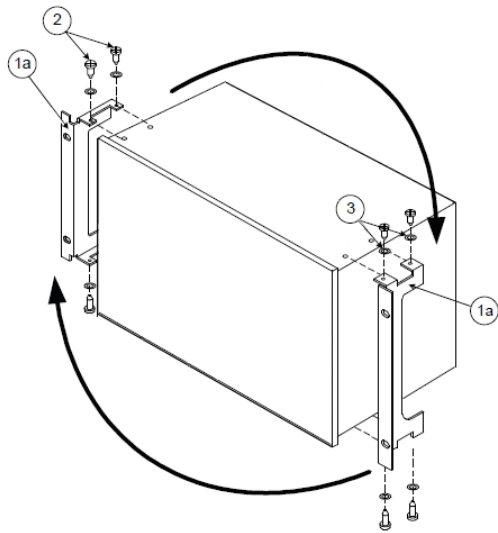


# SAM600-IO

## Mounting variants

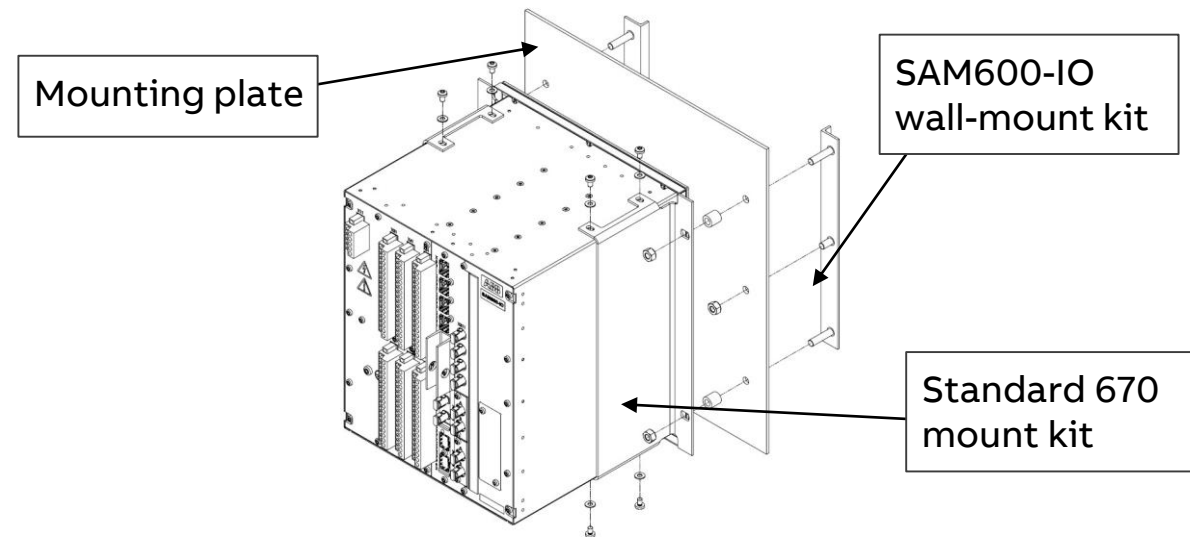
### Swing-frame mount

- Use of standard mounting kit
- Empty front-plate facing user, connectors on the back



### Wall-mount

- Optional wall-mount kit for SAM600-IO
- Makes use of existing mounting kit for fixating the device
- Wall-mount kit is fixed to cubicle mounting plate from back in a first step



# SAM600-IO

## LHMI service kit

### Usage

- LHMI embedded in a rugged carrying case
- Connects to SAM600-IO through (covered) LHMI connector in TRM slot
- Available as accessory

### Usage

- Display HW status and configuration
- Enable recovery and firmware updates through „front port“





# SAM600-IO

## Functionality and options

### Functionality

#### Switchgear operations

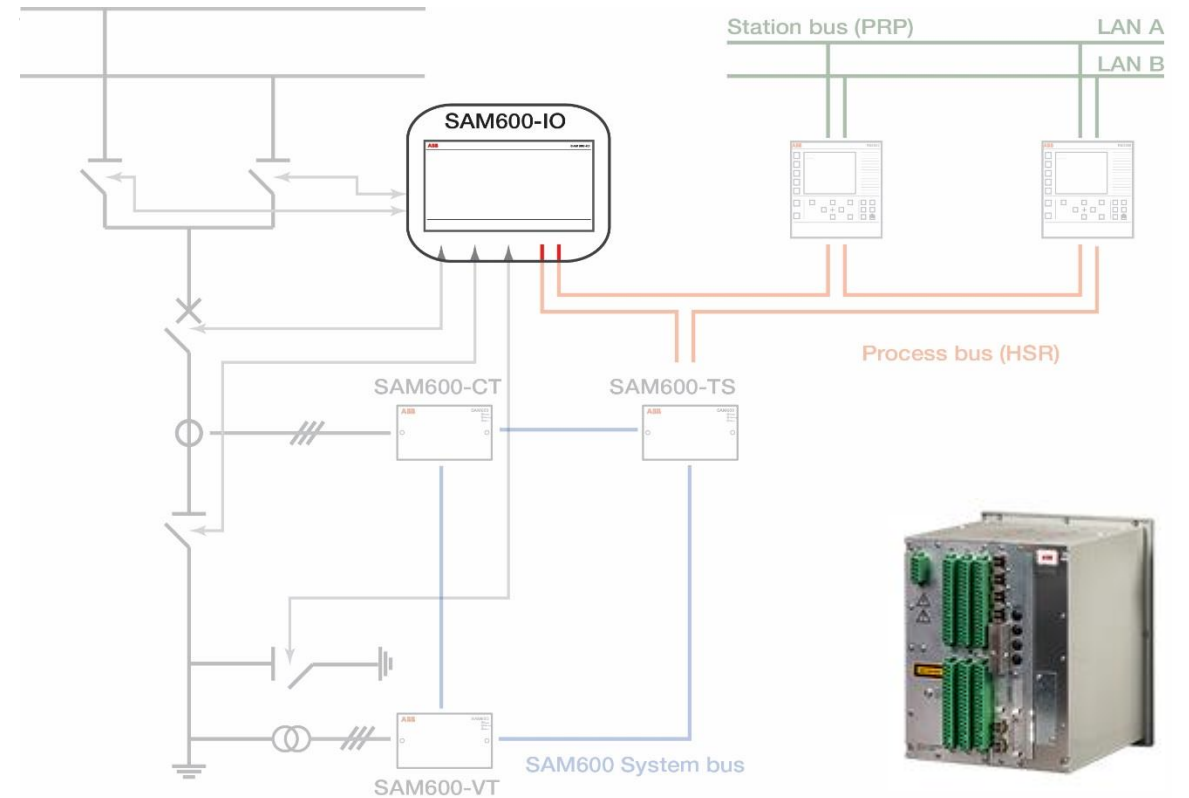
- Basic package with 1 XCBR (3 phase) and 18 SXS WI instances
- Optional package with +2 XCBR (3 phase )
- Supervision, breaker cond monitoring

#### Logic

- All logic functions from ACT (tripping, trip matrix, boolean, timers)
- Disturbance records

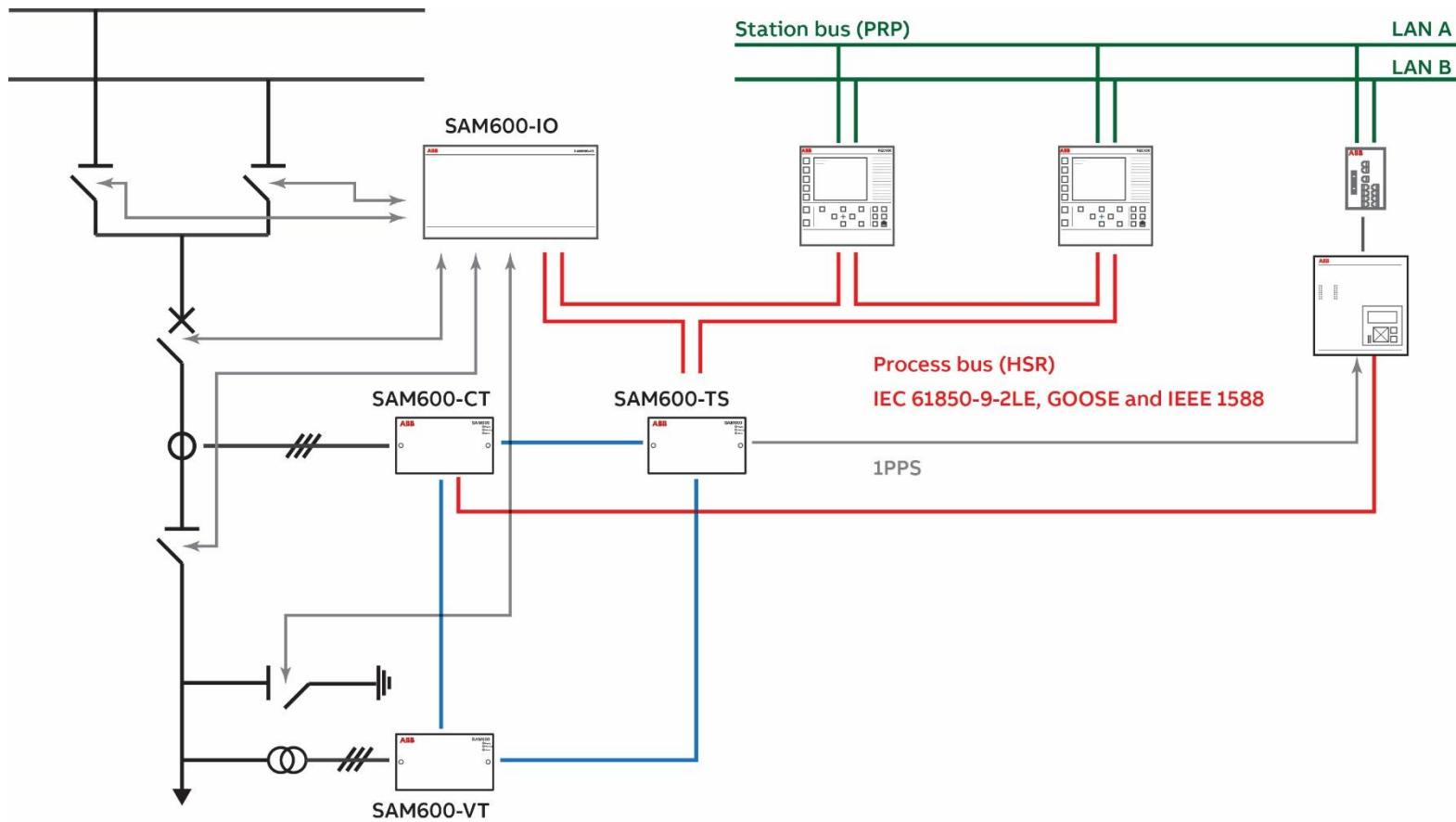
#### Communication and time sync

- HSR, PRP, IEC/IEEE 61850-9-3



# SAM600 – the digital substation enabler

## Application example – line feeder

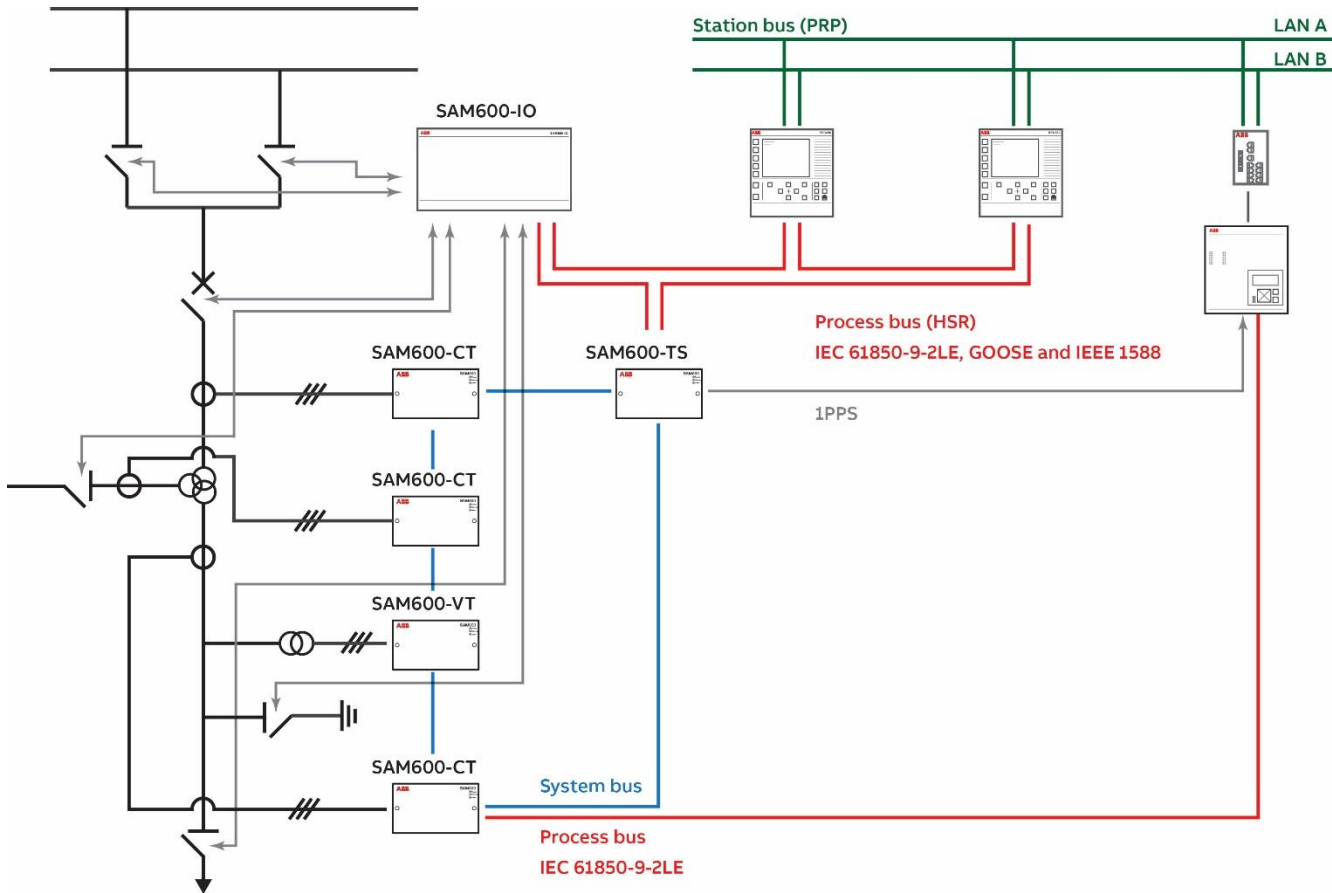


### Line feeder arrangement

- One SAM600-IO device for interfacing I/O for complete primary apparatus for feeder
- SAM600 merging units according to voltage and current instrument transformers
- Process bus realized between process and bay level through HSR
- Supports IEC/IEEE 61850-9-3 time sync, GOOSE and 9-2LE traffic
- SAM600 also supports integration of existing equipment via single links and PPS replication, e.g. FOCS sensor

# SAM600 – the digital substation enabler

## Application example – transformer feeder



### Transformer feeder arrangement

- One SAM600-IO device for interfacing I/O for complete primary apparatus for feeder
- SAM600 merging units according to voltage and current instrument transformers
- Process bus realized between process and bay level through HSR
- Supports IEC/IEEE 61850-9-3 time sync, GOOSE and 9-2LE traffic
- SAM600 also supports integration of existing equipment via single links and PPS replication, e.g. FOCS sensor

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# Product information

## On the web

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### SAM600 process bus I/O system - Enabling the digital substation

SAM600 integrates conventional instrument transformers into modern, IEC 61850-9-2 process bus substation automation, protection and control systems.


The modular design of SAM600 enables safe, efficient, and extendible retrofit of any substation. In order to maximize the benefits of IEC 61850 process bus, SAM600 modules can be placed in the switchyard close to the primary apparatus in marshalling kiosks.

Digital technology has already revolutionized communications across utility networks, and now the same techniques are being applied within the substation to enable robust, fast, and responsive messaging over Ethernet.


The SAM600 exists in four product variants:




**SAM600-CT**  
for current measurements




**SAM600-VT**  
for voltage measurements



**SAM600-TS**  
for optimal time synchronization



**SAM600-IO**  
for interfacing primary apparatus in the switchyard



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Product Guide SAM600 process bus I/O systems	Product Guide SAM600-IO	Release SAM600-IO release 2.2	Brochure I am SAM600 process bus system	ABB Library Access the ABB Library for more documents	On-demand webinar Join Thomas Werner, product manager for SAM600, in our on-demand webinar
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## User documentation

Full set of user documentation available on ABB website

- Product guide
- Manuals
- Wiring diagrams
- Type test certificate
- IEC 61850 conformance documents



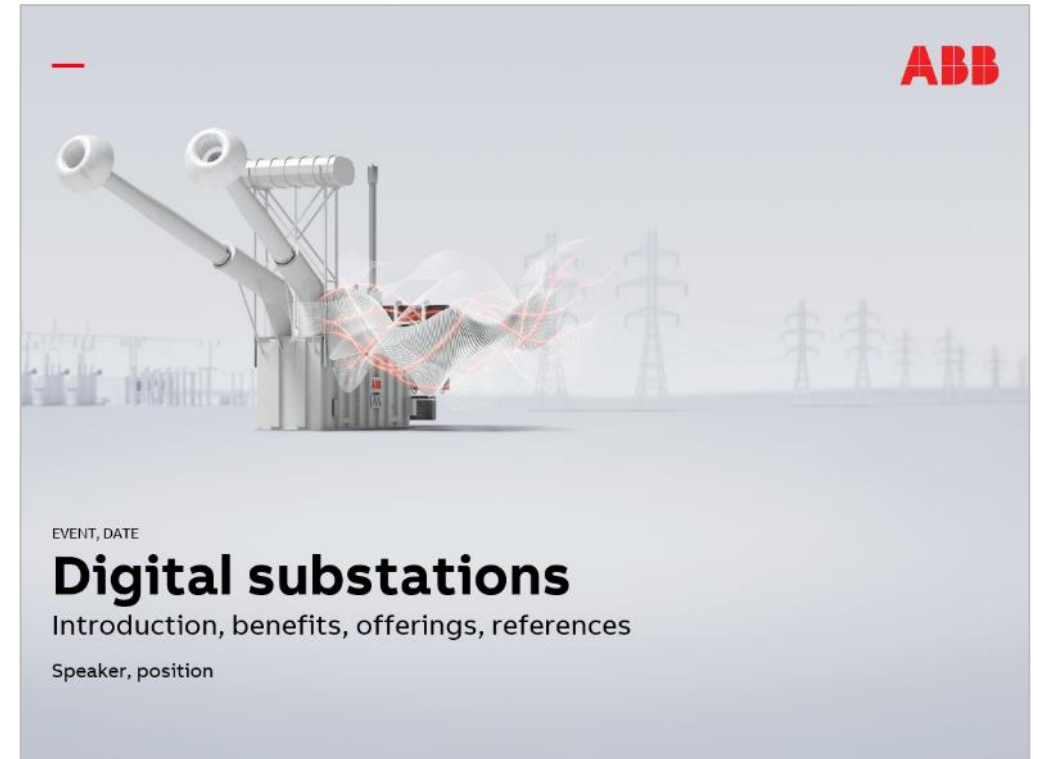
# Product training

## Trainings

Training course CHP157 available at ABB University CH  
Roll-out to other locations during H2/2018

### Topics

- Introduction to digital substation
- Relevant standards and technologies
- System aspects for designing robust digital substations
- Introduction to SAM600 & configuration
- Troubleshooting
- Practical exercises on SAM600 demo system, stepwise setup of a 9-2LE and GOOSE application with REC670



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# Digital substations

Highlights,  
worldwide



**UK, 2018\***  
SAM600, FOCS  
670series, 3<sup>rd</sup> party



**UK, 2014**  
GIS NCIT,  
670 series



**PL, 2018**  
SAM600  
670 series



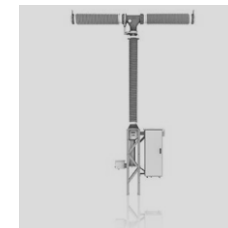
**Sweden, 2010**  
DCB with FOCS,  
670series



**Sweden, 2013**  
AIS 3<sup>rd</sup> party NCIT,  
670, 630, 615series



**Germany, 2012**  
3<sup>rd</sup> party NCIT,  
REB500



**CN, 2016 (several)**  
DCB with FOCS  
3<sup>rd</sup> party



**US, 2016**  
DTB with FOCS,  
SAM600, 670 series



**Taiwan, 2014**  
SAM600  
670series, 3<sup>rd</sup> party



**Taiwan, 2017**  
SAM600  
670series, 3<sup>rd</sup> party



**Australia, 2009**  
GIS NCIT, 3<sup>rd</sup> NCIT  
670series

**3 more projects in AU**  
are under execution



**Brasil, 2017**  
SAM600  
670series



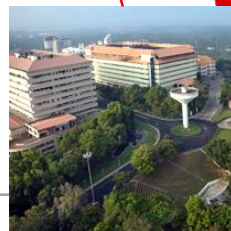
**Switzerland 2009**  
GIS NCIT,  
670series, REB500



**Switzerland 2011**  
GIS NCIT,  
670series, 3<sup>rd</sup> party





**CZ, 2017**  
FOCS, SAM600



**India, 2017\***  
SAM600  
670, 615 series



**Australia 2011**  
67 GIS NCIT,  
670series, REB500

 Laboratory tests  
 Installations





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# Contact us for support

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