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SIPROTEC Product News

Stefan Flemming I PLM Process Bus & Communication


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1A
1B
1C
1D
2B
B
C
D
F
G
H

Do you know …

Low Power Instrument Transformers (LPITs) will **reduce HV switchgear size** by 30%

You can achieve **higher performance** in measurement

You can **save cost** by reduced wiring

Improve worker **safety**

Low Power Instrument Transformers **weight 90% less**

You gain **flexibility** throughout lifetime to adapt easily to future needs

Remote maintenance and testing **saves cost**

?

Digital Substation 4.0
Process Bus Overview

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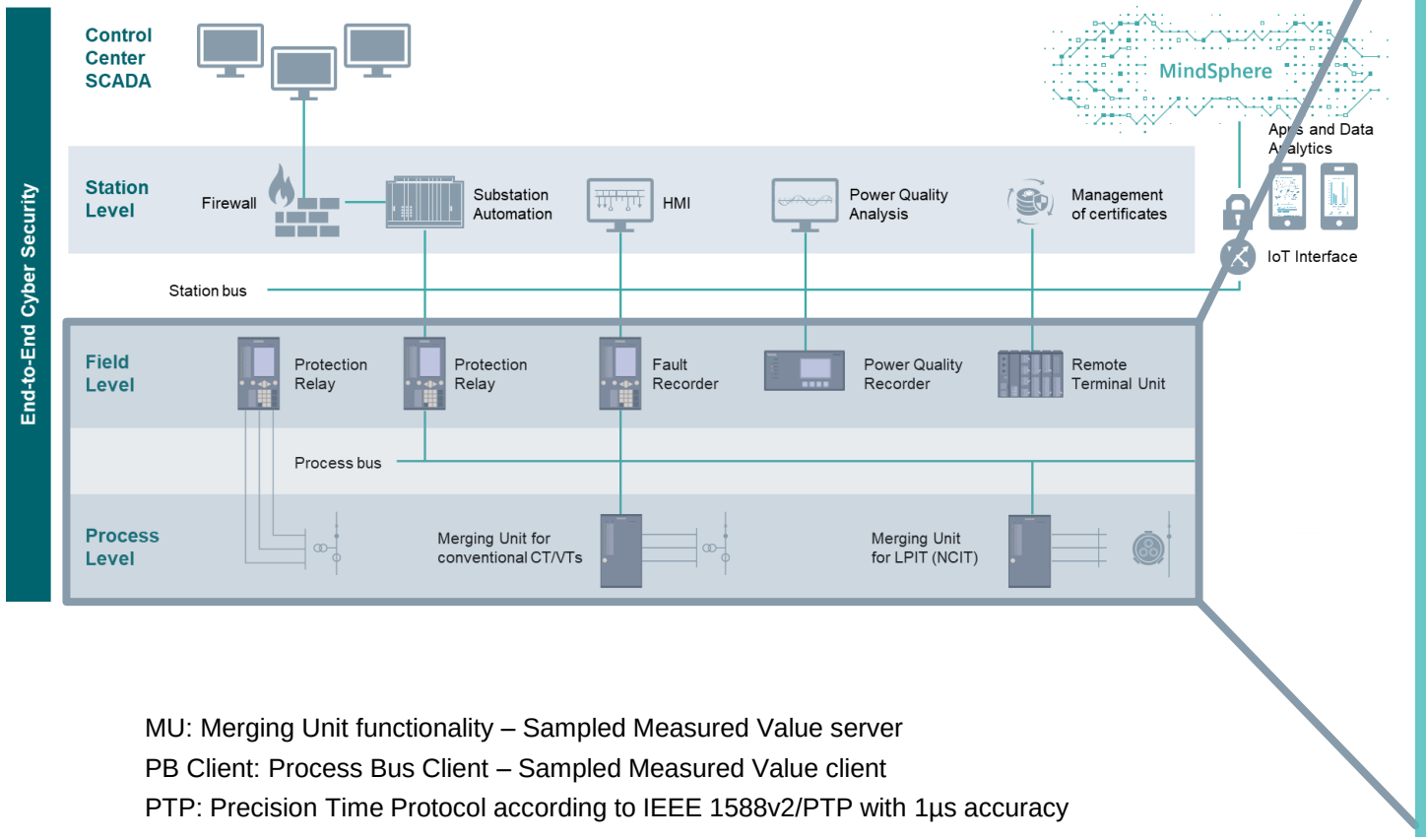

Benefits

- Flexible solutions for different level of digitalization
- Process bus closes the gap to a fully digitalized system
- Agile for future requirements
- Digitalization of all primary data close to the process
- Data for optimizing grid control and monitoring
- Remote engineering and testing

MU: Merging Unit functionality – Sampled Measured Value server
PB Client: Process Bus Client – Sampled Measured Value client
PTP: Precision Time Protocol according to IEEE 1588v2/PTP with 1µs accuracy

Digital Process Level
Process bus with SIPROTEC 5

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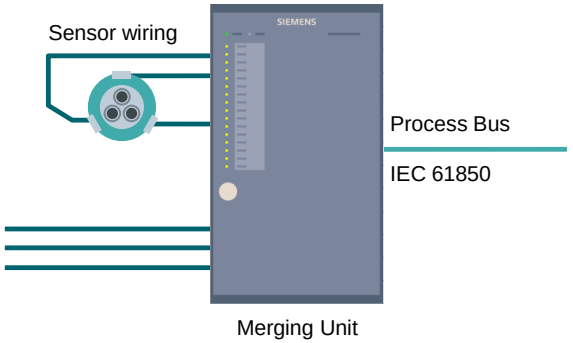
Primary equipment with LPITs

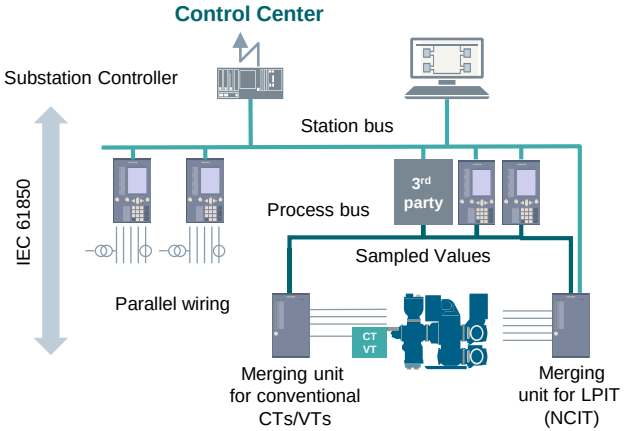
- Cost saving – reduced space and 90% reduced weight of transducers
- Cost saving – One LPIT type for protection and measurement in all feeders because of the wide dynamic range
- Operational safety – danger of open CT circuits obsolete or reduced

Merging Unit



- Cost saving – copper cable reduction, faster installation and commissioning
- Independency – interoperable design enables multi-vendor solutions based on IEC 61850 standard
- Improved safety – isolation of electronics in the control room

Process bus implementation



- Advanced functionality
- Flexibility and scalability – easier adaptation to future requirements and integration of wider range of data sources (independent signal routing, adding additional devices)

Parallel Protection Function sourced from SMV via Process Bus and CIT

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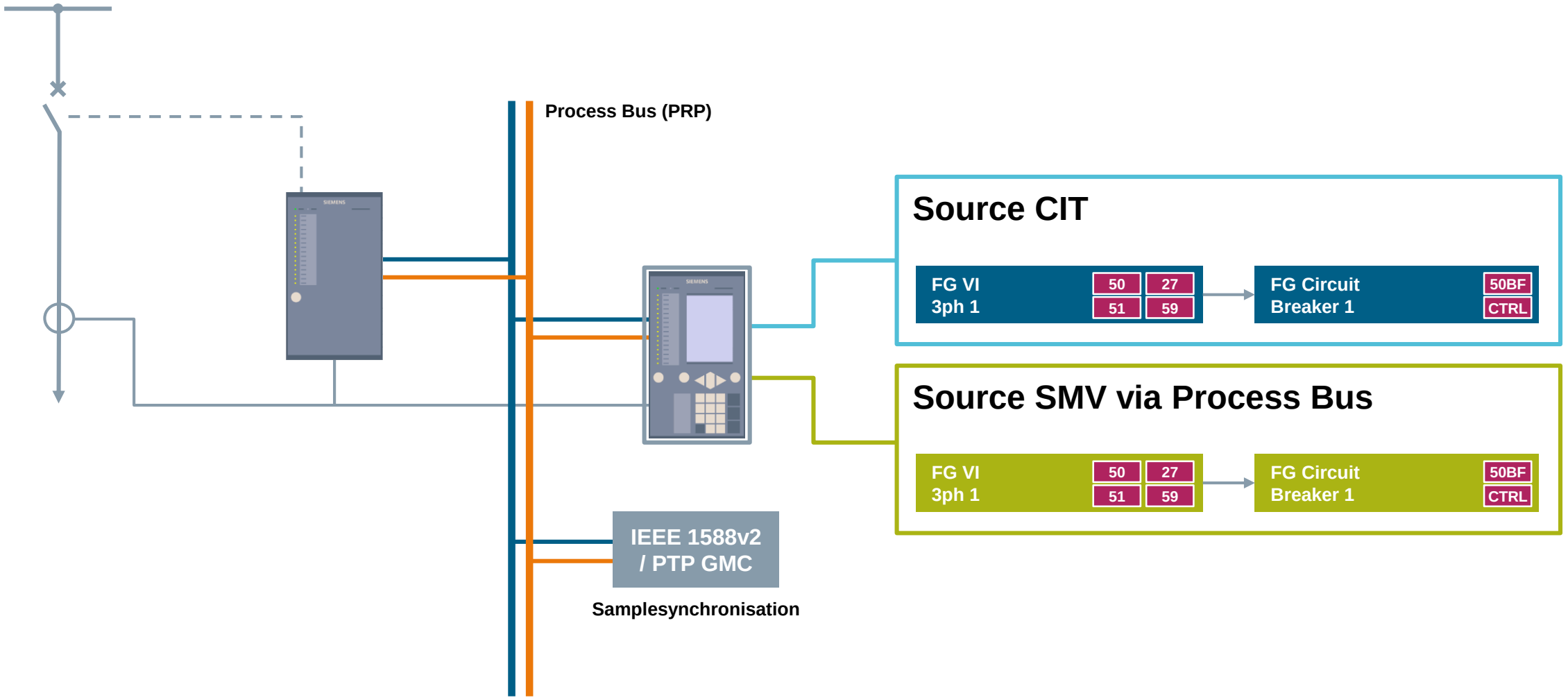
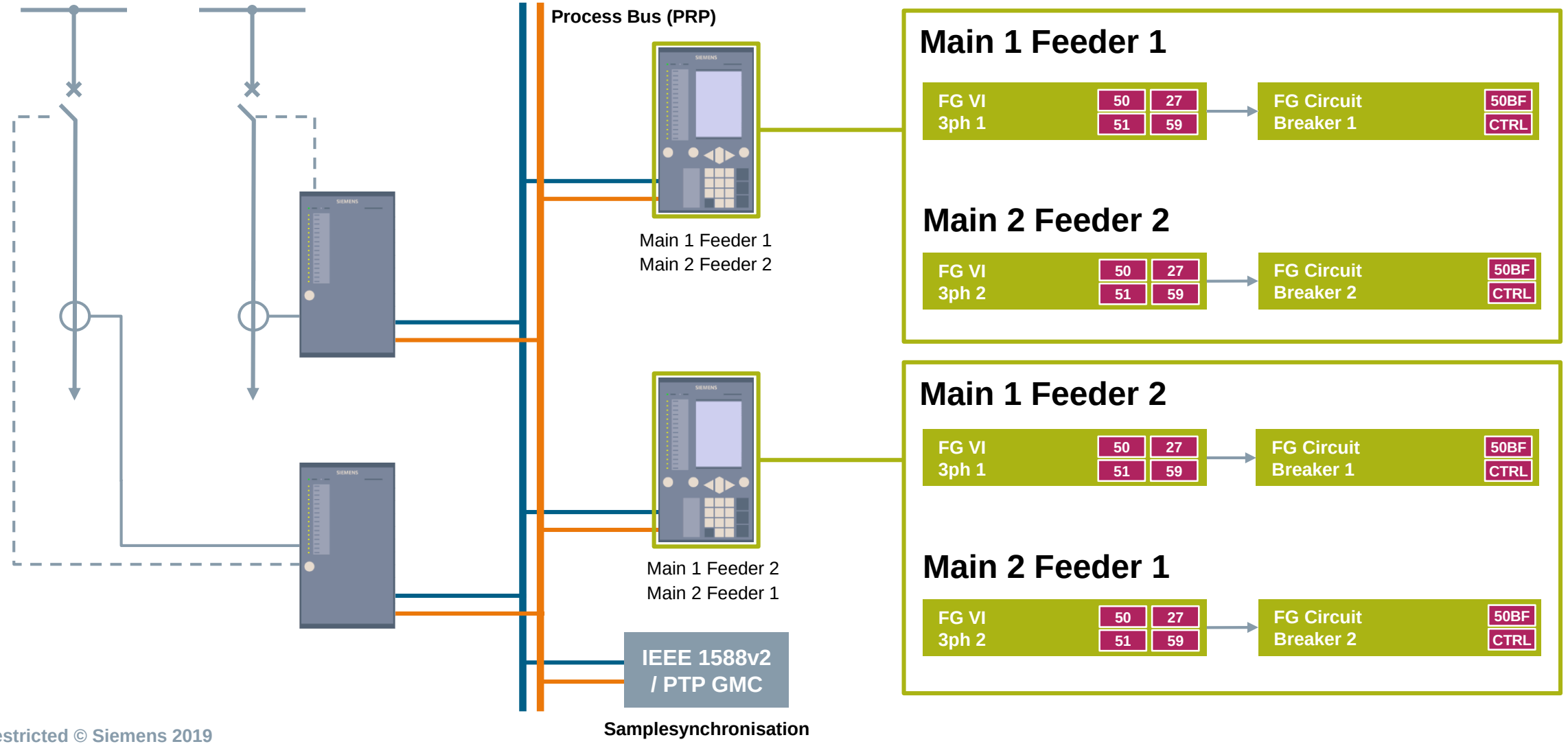


Redundant Protection
via cross subscription of one IED to multiple feeders



Central Protection for small substations

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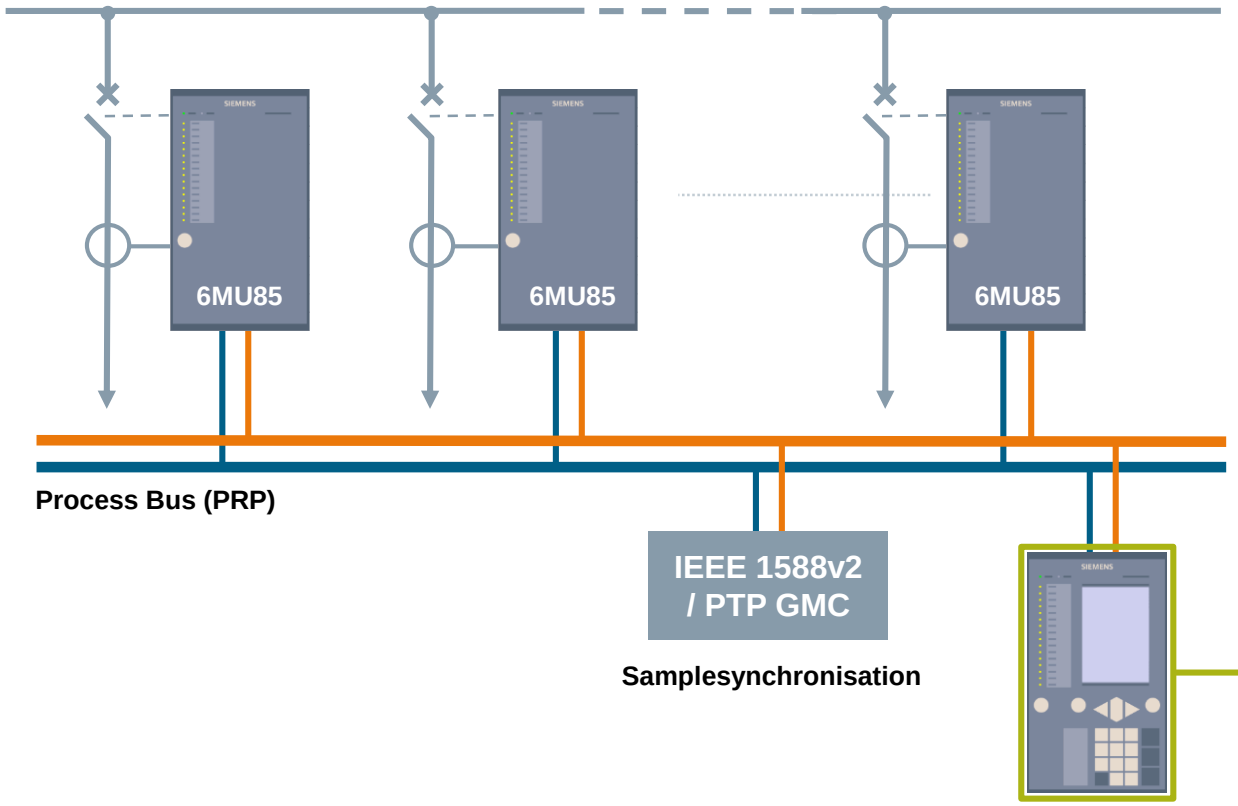
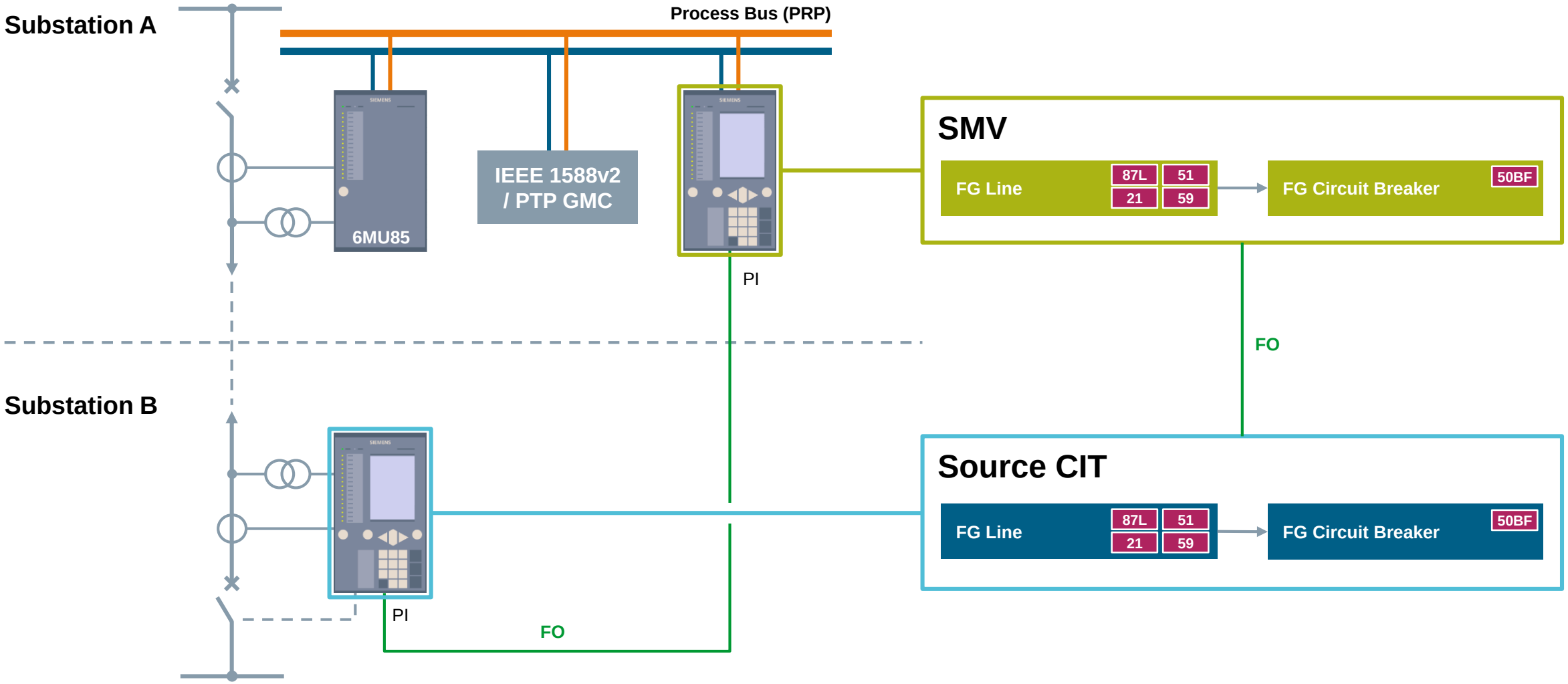


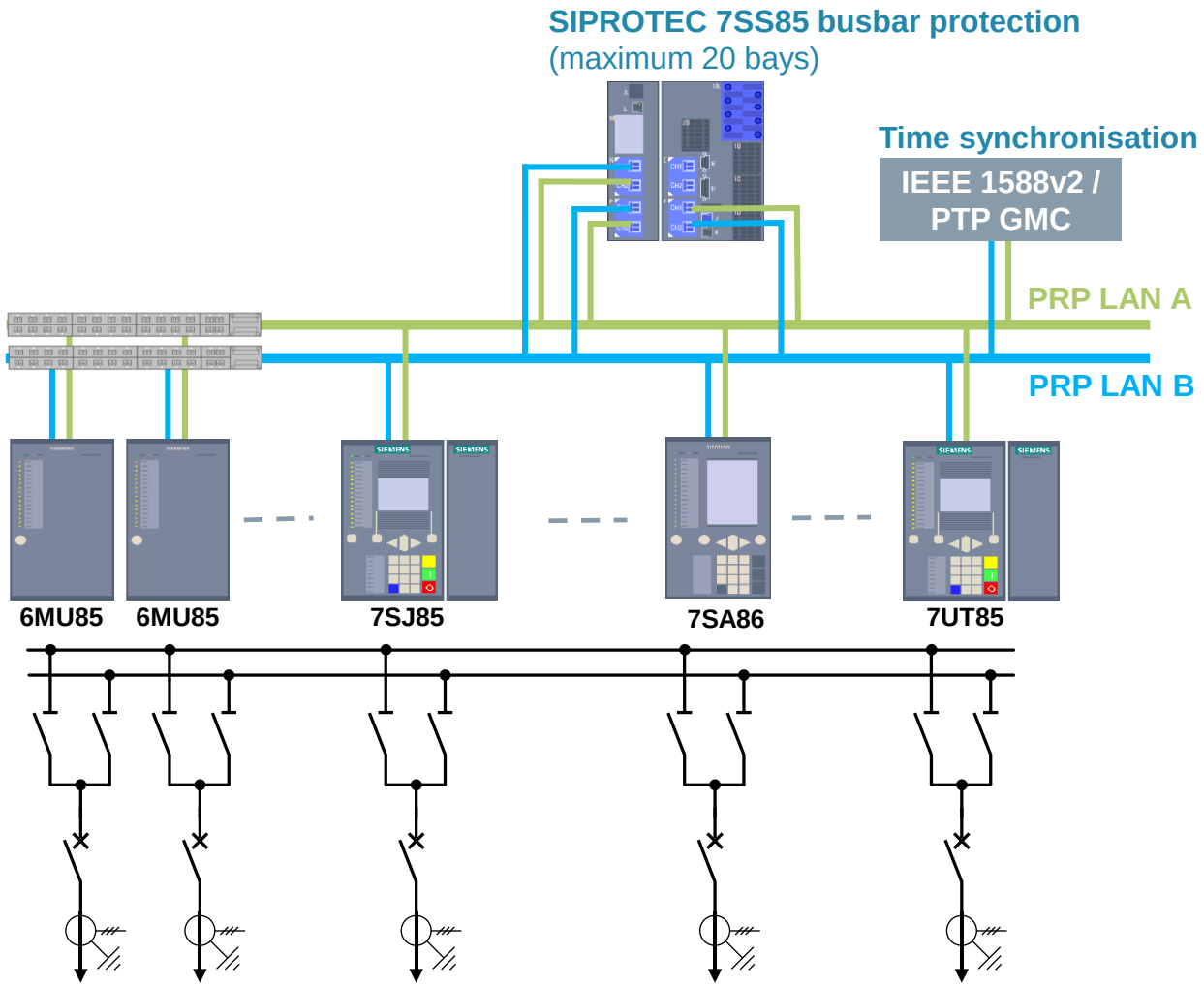
Central Protection with 7SS85

FG VI 01 3ph 1	50	67	FG Circuit Breaker 1	50BF
	51	21T		CTRL
FG VI 02 3ph 1	50	67	FG Circuit Breaker 2	50BF
	51	21T		CTRL
FG Bus	87BB			
FG VI 10 3ph 1	50	67	FG Circuit Breaker 10	50BF
	51	21T		CTRL

Application Examples
Line Differential Protection – Mixed configurations



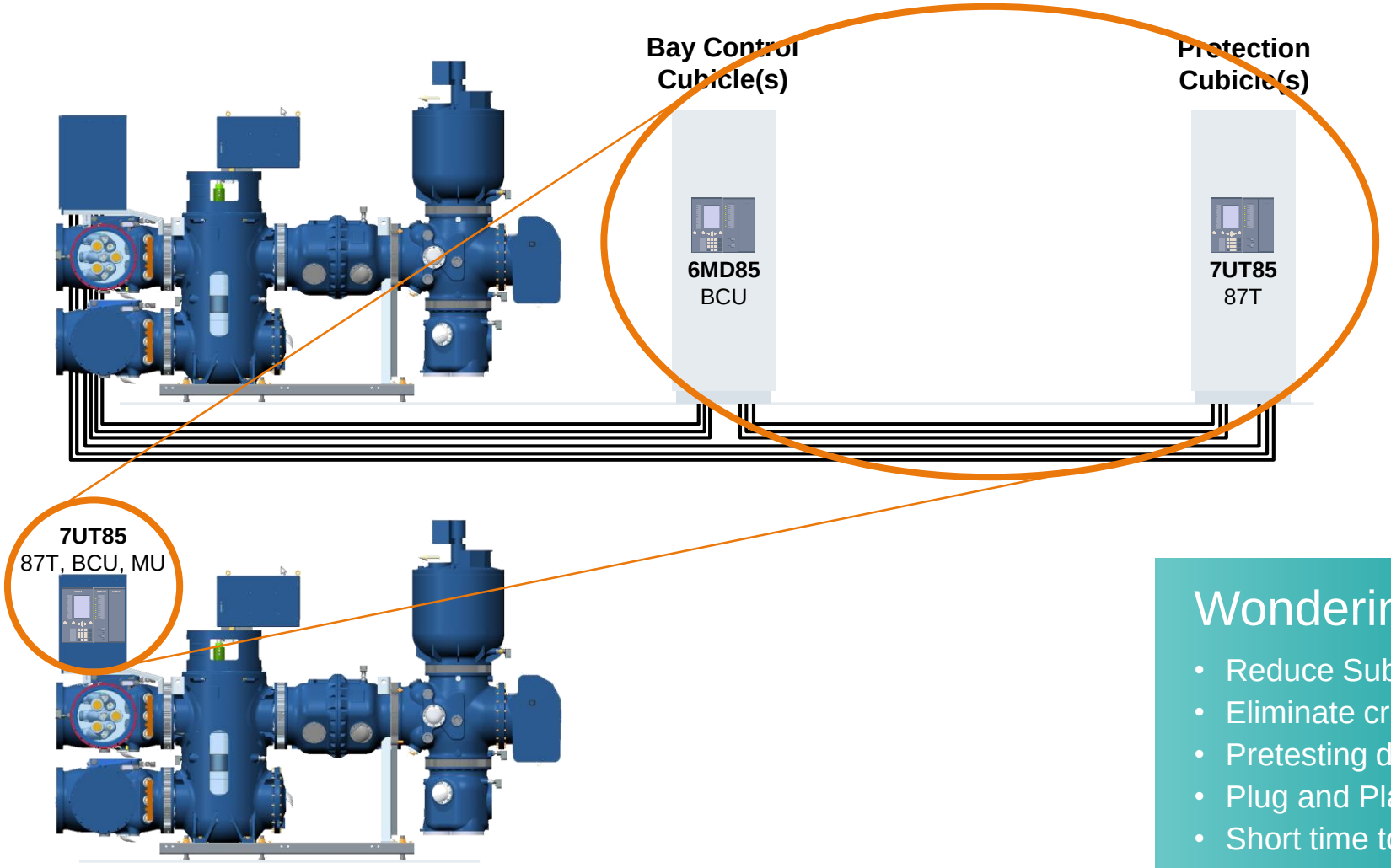
Decentralized busbar protection
SIPROTEC 7SS85



Smart transition of energy systems

- For 20 measuring points (up to 20 bays)
- Interoperable IEC 61850 busbar protection solution
- Decentralized process data acquisition:
  - Merging Unit SIPROTEC
  - Every modular SIPROTEC 5 device
  - Third party merging unit
- Simple expansion of existing SIPROTEC 5 systems with decentralized busbar protection
- Open engineering through standard IEC 61850 configuration tools and DIGSI 5

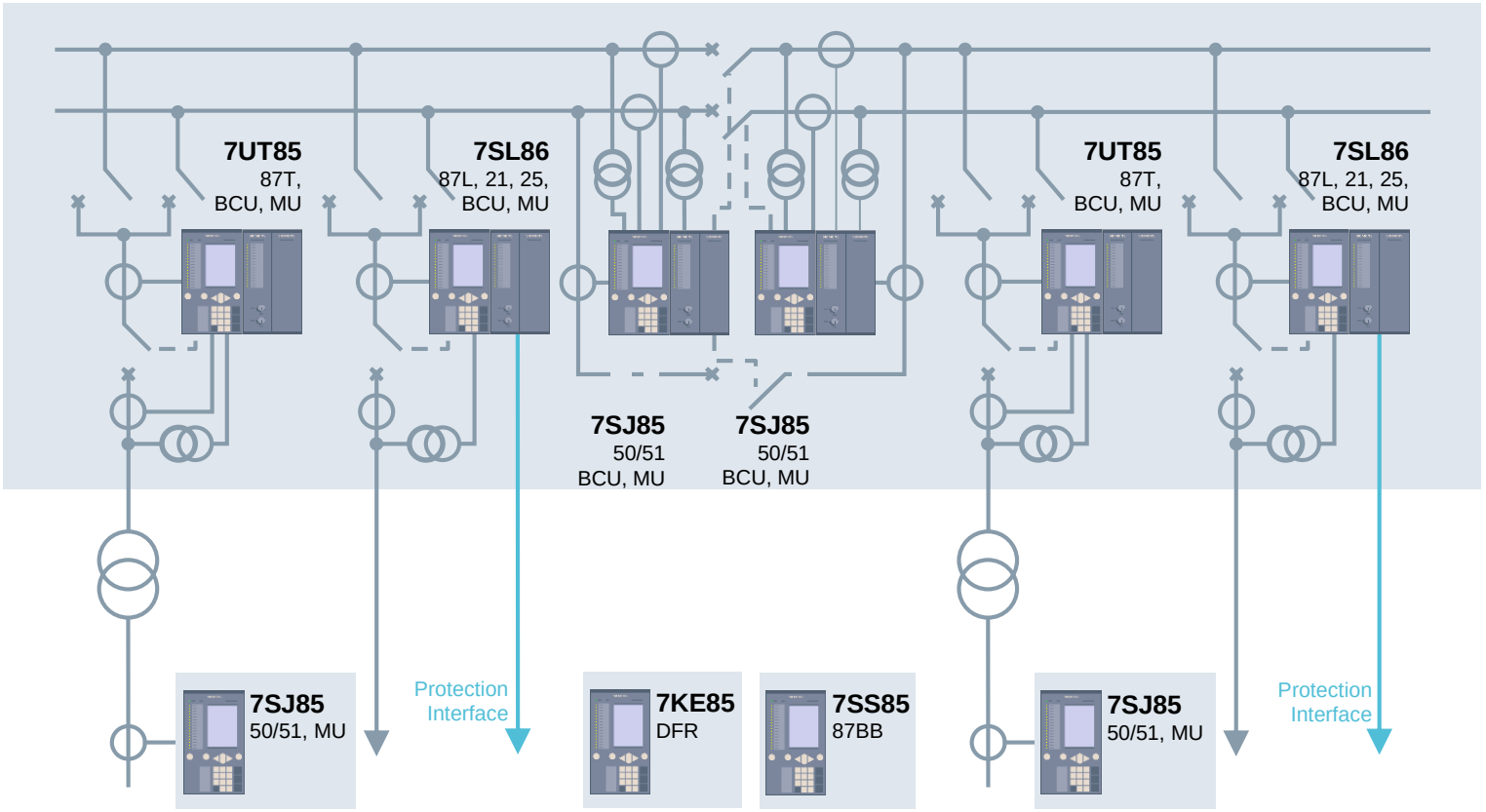
Highly integrated GIS solution
Integration into Substation Automation System



Wondering how to

- Reduce Substation footprint
- Eliminate cross feeder wiring
- Pretesting during FAT
- Plug and Play on site
- Short time to operation

Highly integrated GIS solution



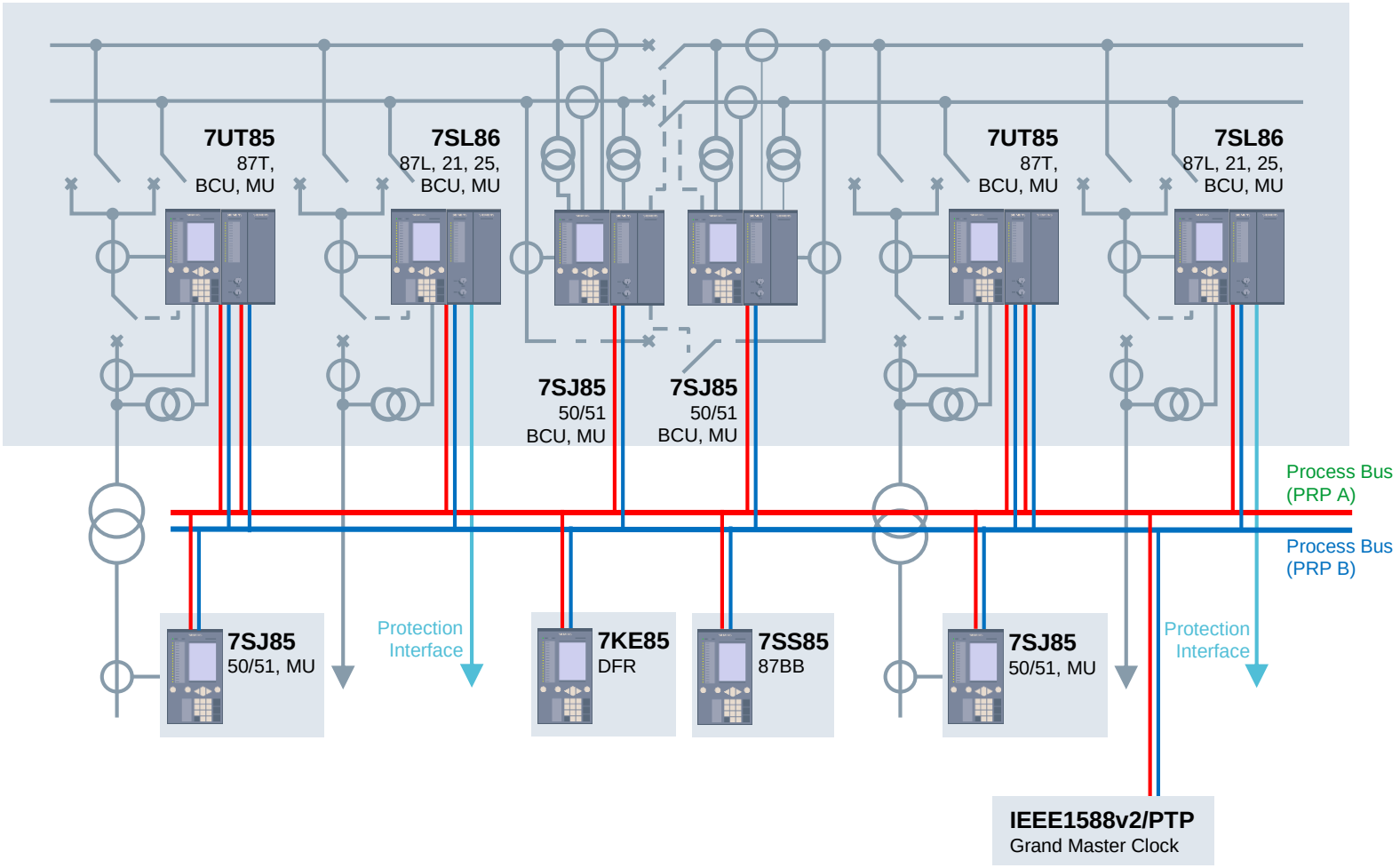
Design principals

- IED's installed in the GIS control cubicle
- IED's operate as
  - Protection Unit
  - Merging Unit (MU)
  - Bay Control Unit (BCU)

Benefits

- No cross feeder wiring
- No dedicated Merging Units
- No dedicated protection and control cubicles
- Pretesting during FAT
- Plug and Play on site
- Short time to operation

Highly integrated GIS solution
Configuration of Process Bus



Design principals

- Process bus IEC 61850-9-2
- Redundancy Protocol HSR
- IEDs assigned to the feeder
- IEDs for central tasks (7KE85 and 7SS85) connected to process bus

Benefits

- No cross feeder wiring
- No dedicated Merging Units
- No dedicated protection and control cubicles
- Pretesting during FAT
- Plug and Play on site
- Short time to operation

Highly integrated GIS solution
Integration into Substation Automation System

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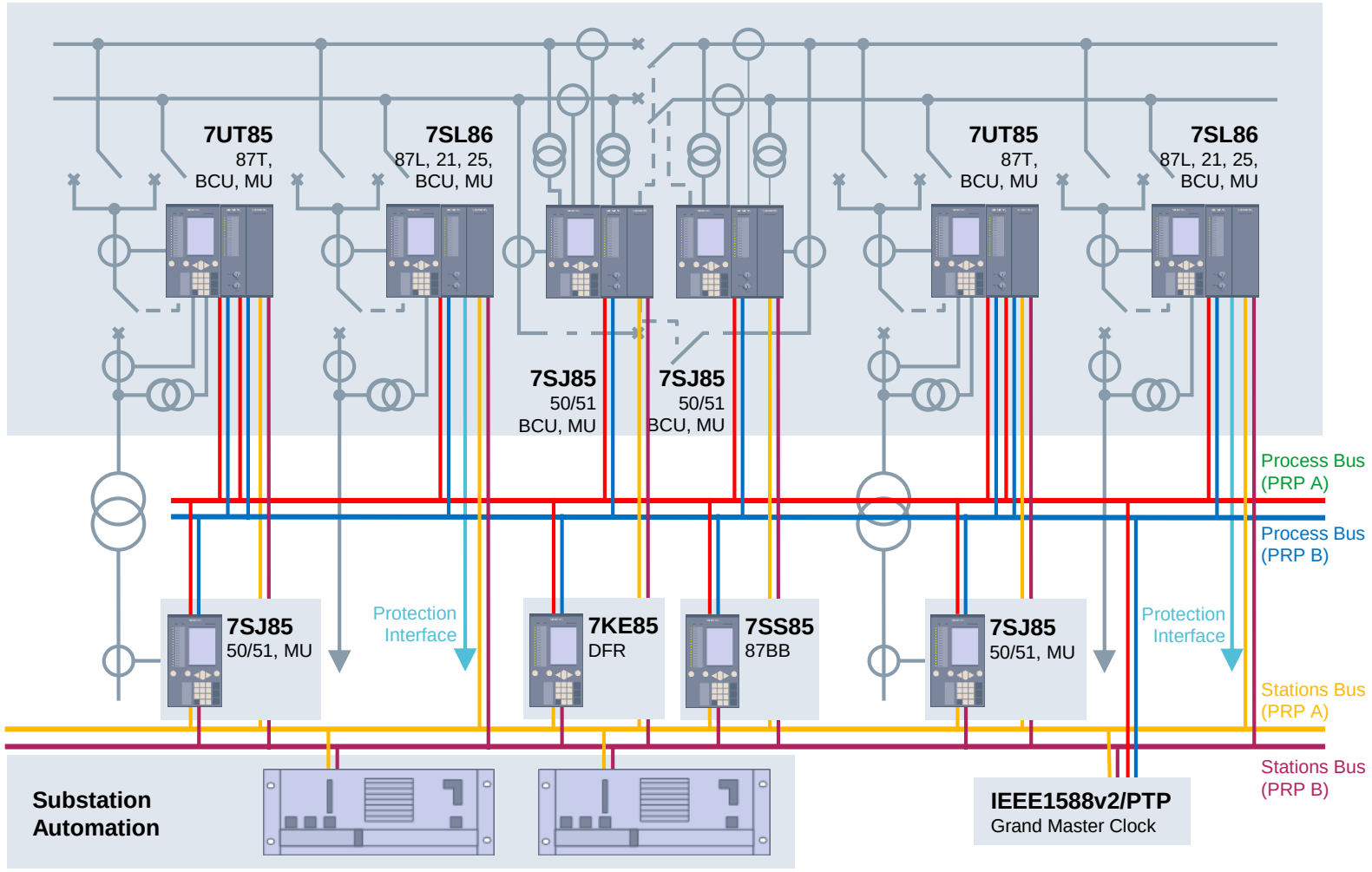

Design principals

Redundant station bus with PRP

Benefits

- No cross feeder wiring
- No dedicated Merging Units
- No dedicated protection and control cubicles
- Pretesting during FAT
- Plug and Play on site
- Short time to operation

SIPROTEC 5
Merging Unit functionality

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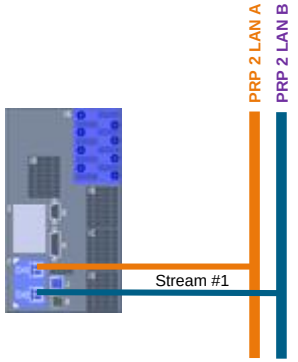
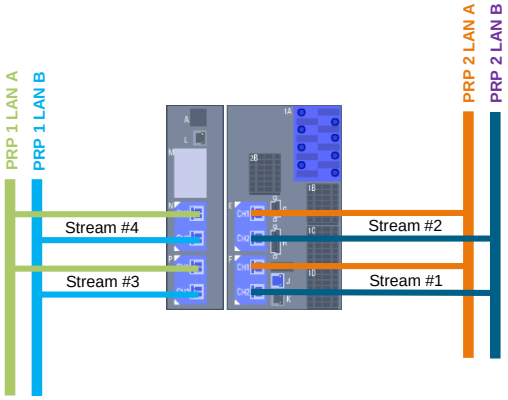
- Ethernet communication module **ETH-BD-2FO** for process bus functionality required
- One Sampled Measured Value (SMV) stream per ETH-BD-2FO Ethernet module
  - up to 32 analog values in any combination of CT and VT
  - or 4x CT, 4x VT (IEC 61850-9-2LE)
- Up to 4 **ETH-BD-2FO** modules supported
- IEC 61869-9, IEC 61869-13 compliant
- IEC 61850-8-1 GOOSE, MMS and Merging Unit protocol on the same Ethernet module
- Sample synchronization via IEEE 1588v2/PTP
- Engineering with DIGSI 5 and IEC 61850 System Configurator



Example:
Minimum configuration of SMV streams



Example:
Maximum configuration of four SMV streams, publishing to two physically separated networks (four networks possible)

	MU
7SA86, 7SA87	✓
7SD86, 7SD87	✓
7SL86, 7SL87	✓
7VK87	✓
7UT85, 7UT86, 7UT87	✓
7SK85	✓
7UM85	✓
7VE85	✓
7SS85	✓
6MD85	✓
6MD86	✓
6MU85	✓
7KE85	✗
7SJ81, 7Sx82 (non modular)	✗
7ST85, 6MD89	✗

Availability of Merging Unit functionality (server)

SIPROTEC 5 – 6MU85 Merging Unit
Perfectly tailored fit to your requirements (examples shown)

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CT	4 protection
VT	4
BI	19
BO-STD	9
BO-HS	4

CT	12 protection 4 measurement
VT	4
BI	255
BO-STD	43
BO-HS	8
4 … 20 mA	4
RTD	12

CT	8 protection
VT	4
BI	59
BO-STD	47
BO-HS	8

CT	4 protection
VT	0
BI	27
BO-STD	17

Perfectly tailored fit

- Adoptable to multiple CT, VT, LPIT inputs
- Scalable BI and BO
- Direct “high speed” tripping of circuit breaker <1 ms
- Collection of additional data (temperature, pressure, tap changer positions, …)
- Redundant power supply
- Expendable by a 2nd row

SIPROTEC 5 – 6MU85 Merging Unit
Digitalization of all primary data close to the process

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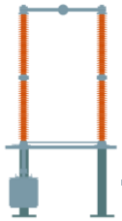


Disconnector
Control and Position

Circuit Breaker
Trip, Control and Position
Trip Circuit Supervision
Point on Wave Switching

Logic for transformer cooling group control

Field/Bay Interlocking

Automatic voltage regulator

User defined logic

measurement core
protection core

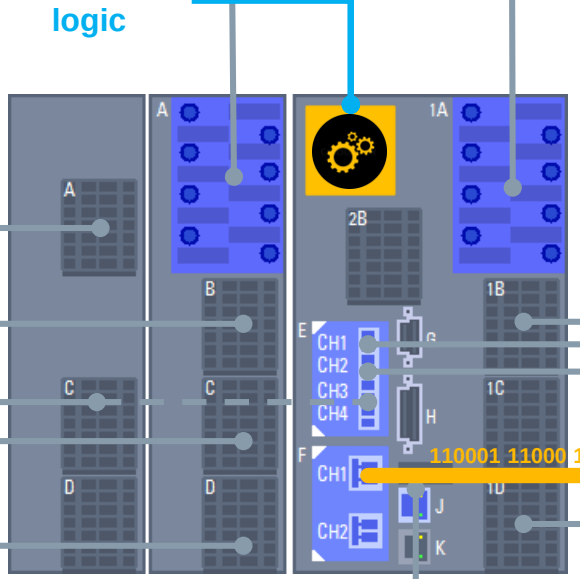
Inductive Current Transformer
1A, 5A

Inductive Voltage Transformer

Flow sensor
4..20 mA

Tapchanger
Position and Control
digital or 4..20mA

Temperature Sensor
4..20 mA



110001 11000 100011 00001110 1111 110001 11000 100011 01110

IEC 61850-9-2 and IEC 61850-8-1 GOOSE

Buchholz Relay
Trip and Alarm

pressure relief devices

Temperature Sensor
up to 12x PT100

TR1200 IP

Pressure sensor
for SF6, …

SIPROTEC 5
Process Bus Client

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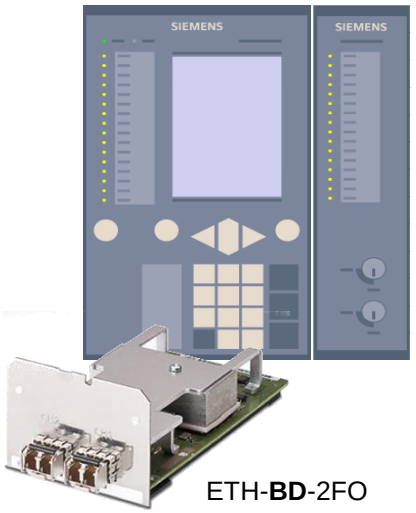
- Ethernet communication module **ETH-BD-2FO** necessary
- Up to 32 analog values per ETH-BD-2FO (up to 80[1)] using 3x ETH-BD-2FO)

- Support of IEC 61850-9-2LE streams
- Support of IEC 61869 flexible streams
- IEC 61850-8-1 GOOSE, MMS and Process Bus Client protocol on the same module

- Supported protection functions 87B, 87L, 87T, 21,
- 67/67N, 50/50N, 51/51N, … [2)]
- Test- and Simulation Bit support
- Sample synchronization for mixed configurations of direct connected instrument transformers and sampled measured values via IEEE 1588v2/PTP
- Interoperability with multivendor merging units [3)]



ETH-**BD**-2FO

- Engineering with DIGSI 5 and IEC 61850 system configurator

	PB Client
7SA86, 7SA87	✓
7SD86, 7SD87	✓
7SL86, 7SL87	✓
7VK87	✓
7UT85, 7UT86, 7UT87	✓
7SK85	✓
7UM85	✓
7VE85	✓
7SS85	✓
6MD85	✓
6MD86	✓
6MU85	✓
7KE85	✓
7SJ81, 7Sx82 (non modular)	✗
7ST85, 6MD89	✗

Availability of Process Bus Client functionality

1) Limitations: network bandwidth of 100Mbit/s, limitation of 40 analog values per SIPROTEC 5 device (except 7SS85 limit of 80 values)
2) 87L supports two terminals
3) Interoperability is regulated in IEC 61850-9-2 Edition 2.1 (not published at this time), use of 3rd party MU must be coordinated with DG SA&P headquarter

Digital Process Level
Summary - Shown: GIS Clean Air 145 kV

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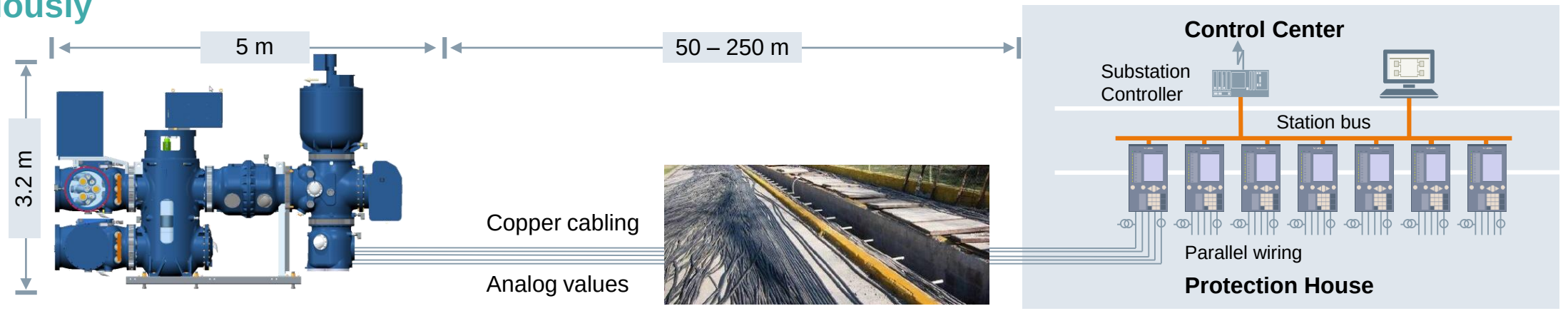
Previously



Digital

SIPROTEC 5
New Ethernet module – ETH-BD-2FO

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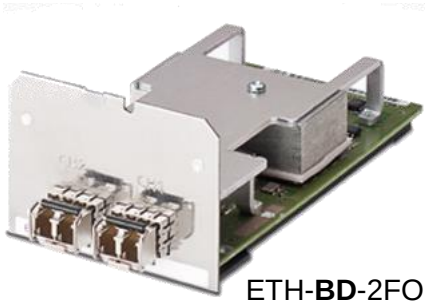
Communication module for the transmission of Ethernet protocols via 2 optical interfaces

Supports modular SIPROTEC 5 devices 7xx85/86/87*

Available protocols (DIGSI 5 V7.90)
- PRP
- Line Mode
- IEC 61850-8-1 GOOSE, MMS
- COMFEDE support via MMS file transfer
- IEEE 1588v2/PTP (1µs accuracy) ordinary slave clock for radial networks (PRP and Line Mode)
- DIGSI 5 protocol
- DCP, DHCP
- Homepage
- WebUI
- SysLog
- RADIUS

Additional protocols (DIGSI 5 V8.00)
- Process Bus Client
- Merging Unit

Connector type	2 x duplex LC
Wavelength	λ = 1300 nm
Baud rate	100 Mbit/s
Max. line length	2 km for 62.5 µm/125 µm optical fibers



ETH-**BD**-2FO

Transmit Power	Minimum	Typical	Maximum
50 µm/125 µm, NA1 = 0.2	-24.0 dBm	-21.0 dBm	-17.0 dBm
62.5 µm/125 µm, NA1 = 0.275	-20.0 dBm	-17.0 dBm	-14.0 dBm

Receiver sensitivity	Maximum -12.0 dBm Minimum -31.0 dBm
Optical budget	Minimum 7.0 dB for 50 µm/125 µm, NA1 = 0.2 Minimum 11.0 dB for 62.5 µm/125 µm, NA1 = 0. 275
Interface design	Corresponds to IEEE 802.3, 100Base-FX
Laser class 1 as per EN 60825-1/-2	With the use of 62.5 µm/125 µm and 50 µm/125 µm optical fibers

Comment: 1 numerical aperture (NA = sin θ (launch angle))

*except 7ST85

Time and Sample synchronization
Precision Time Protocol – IEEE 1588v2/PTP

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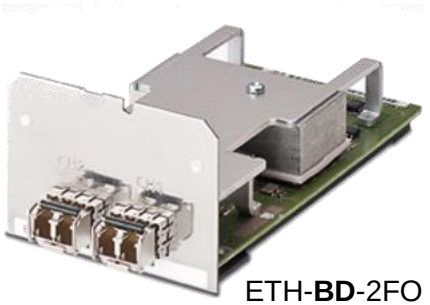
Communication Plug-In Module	NEW ETH-BD-2FO	ETH-BA-2EL ETH-BB-2FO
Protocol	IEEE 1588v2-2008	IEEE 1588v2-2008
Type of implementation	Hardware / FPGA	Software
Accuracy	1µs	1 ms
Supported devices	modular SIPROTEC 5 devices 7xx85/86/87 (except 7ST85, 6MD89)	All SIPROTEC 5 devices
Supported Redundancy	PRP Line Mode	PRP (symmetrical) Line Mode
Supported Profiles	IEC 61850-9-3	
Clock Type	Ordinary Slave Clock (OSC)	Ordinary Slave Clock (OSC)
Applications	• Date and Time synchronization • Sample Synchronization for Process Bus • PMU data synchronization • 87L stabilization for unsymmetrical PI networks	• Date and Time synchronization



ETH-**BD**-2FO

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