Solutions for the Digital Substation

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Digital Substation Motivations

Safety

Situational Awareness / Reliability

Total Cost of Ownership
Merging Units With Protection!
Sampled Values (SV) Solution

• Standalone merging unit
• Breaker controller
• Merging unit with full line protection!
• Standard SEL temperature rating (–40° to +85°C)
Typical Process Bus Architecture

- **Control House**:
  - SEL-421
  - SV Relay
  - SEL-421

- **SV, GOOSE, 1588 PTP**

- **Substation Yard**:
  - SEL-421
  - SEL-401
  - SV MU

- **1588 PTP Clock**
Simplify Your Process Bus
Point-to-Point Architecture

Control House

SV Relay
Switch + PTP Boundary Clock

SV, GOOSE, 1588 PTP

Substation Yard

SEL-421
SEL-401
SV MU
IEC 61850-9-2 Is Not Plug-and-Work

• Careful network engineering is required
• External time synchronization is required
• Extended cyberperimeter may be required
Alternate Way to Deploy Process Bus
Time-Domain Link (TiDL) Technology
What Is TiDL?

**Time-Domain Link Technology**

- IEC 61158 EtherCAT®-based transport
- Point-to-point connections
- Synchronous 24 kHz sampling
- No external time source required
- Cybersecure
- No settings!
Benefits of TiDL Technology

Simplicity

- Point-to-point connections
- Plug and work
- No external time source
Benefits of TiDL Technology
Consistency

- Proven Axion technology
- The relays you know
- Same protection algorithms

- Same relaying schemes
- Same configuration software
TiDL Technology Solves Challenges

- Network engineering
- Time distribution
- Cybersecurity
- Commissioning and troubleshooting
New TiDL Digital Interface Board
Remote Module Interface

- **Commissioning Button**
- **8 Fiber 100 mbps EtherCAT Ports**
- **Commission LED for Network Status**
- **LEDs for Remote Node Status**
Use Off-the-Shelf Axion Remote Nodes and Modules

- **Power Coupler Module**
- **AC Analog Input Module**
- **DI Module**
- **Fast High-Current DO Module**
What Is EtherCAT?
Ethernet for Control Automation Technology

- Ethernet-based field bus technology
- IEC 61158 compliant
- Built for industrial I/O applications
- Used in Axion
- Scalable, distributed, and deterministic
EtherCAT Is Ethernet on the Fly

- Low latency
- Minimum overhead, single frame
- Reads / writes on the fly
TiDL Solves Time Synchronization Challenges

- Relative time domain across system
- No external time source required
- No configuration or network engineering
Submicrosecond Synchronized Sampling

Sample Time

Axion Node A

Axion Node B

±100 ns
TiDL Topologies – SEL-421

IAW, IBW, ICW

IAX, IBX, ICX

VAY, VBY, VCY

VCZ

VBZ

VAZ
Plug-and-Work Commissioning
SEL TiDL Has What You Need

- Copper cost reduction
- Short replacement times
- Improved safety
- Reduced engineering and commissioning cost
- Cybersecurity
- EMP protection
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<th>SEL SV</th>
<th>SEL TiDL</th>
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<tr>
<td>IEC 61850-based</td>
<td>IEC 61158 EtherCAT-based</td>
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<tr>
<td>Ethernet-based point to multipoint, point to point</td>
<td>Fiber-optic point to point</td>
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<td>4.8 kHz sampling</td>
<td>24 kHz sampling</td>
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Solve Substation Challenges
SEL TiDL and SEL SV

Unmatched portfolio of flexible, scalable, and economical solutions for integrating digital CT and PT data in substations.