SEL Digital Secondary System Solutions

Robust solutions designed to modernize your substation

- Achieve simplicity by implementing SEL Time-Domain Link (TiDL®) technology.
- Apply redundant protection in an IEC 61850-9-2 Sampled Values (SV) solution using the only merging units in the world with built-in protection.
- Increase safety by removing high-energy copper cables from areas where personnel work.
- Reduce costs by decreasing materials and the labor required for wiring installation, commissioning, and documentation.
- Minimize misoperations due to wiring errors by reducing the number of physical routing paths and connections.

SEL

Transform the Way You Modernize Your Substation

Utilities around the world have chosen SEL for leading technologies and superior products, services, and solutions since 1984. It started when we introduced the world's first digital protective relay to the electric power industry. Now our digital secondary systems are helping customers further advance how they protect and control the primary equipment in their substations.

Our very first copper-to-fiber solution—placing SEL relays in the substation yard—has helped customers achieve up to an 80 percent reduction in copper, a 75 percent reduction in system installation time, a 77 percent reduction in material costs, and a 77 percent reduction in installation labor expenses. SEL continues to lead the way in substation modernization with our digital secondary system solutions: SEL TiDL technology and SEL SV technology.

Solutions

SEL digital secondary systems help protect and control substation primary equipment using digital devices in the secondary system that transmit data via fiber-optic cables. Our flexible, scalable, and economical solutions are built with rugged, field-tested hardware that can withstand harsh environments. Pick the solution that fits your application:

SEL TiDL Technology

Apply SEL TiDL technology for a simple, fast, and secure solution.

SEL SV Technology

Implement SEL SV technology to achieve the power of IEC 61850 interoperability.

Key Benefits

Increased Safety

SEL digital secondary systems allow you to move high-energy copper cables away from the control house, which decreases the potential for electrical safety hazards, such as open CT connections, where personnel typically work.

Reduced Costs

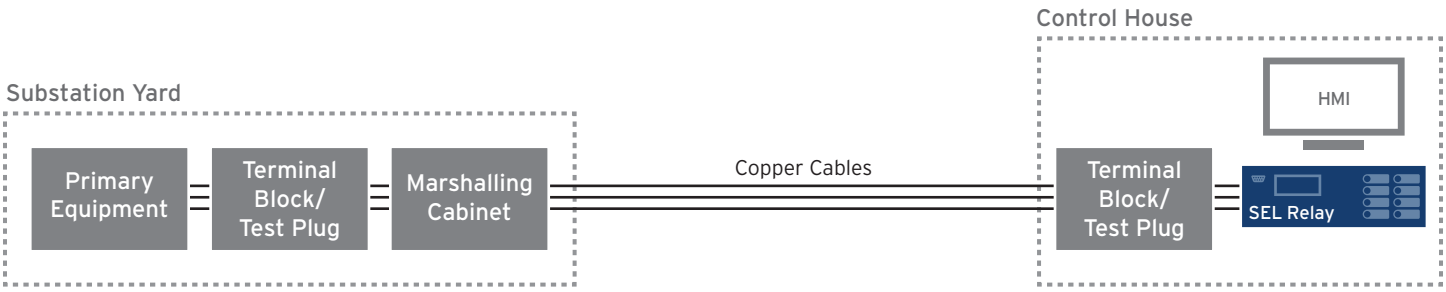
Digital secondary system solutions eliminate a significant quantity of copper cables in a substation yard. Along with reducing the associated material and space expenses, this reduces the labor required for cable routing, installation, commissioning, and documentation.

Improved Reliability

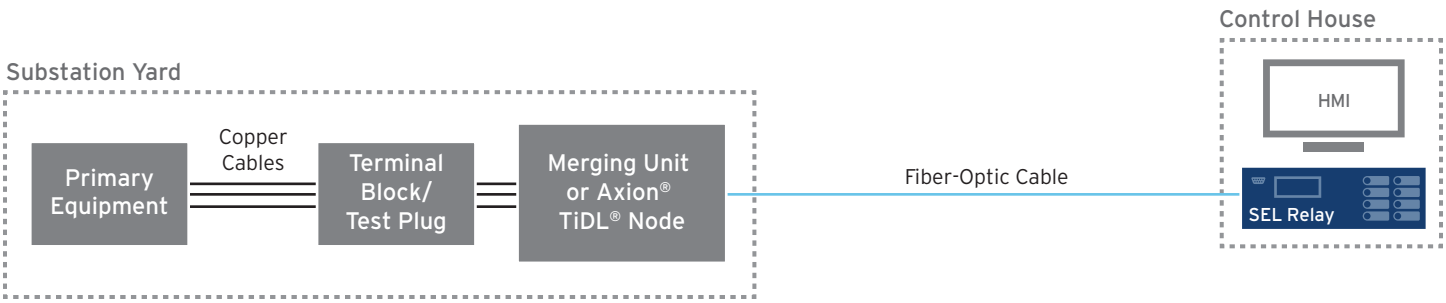
Having fewer copper cables reduces the number of physical routing paths and connections needed, thereby reducing wiring errors and missed connections. Fewer wiring errors reduces time spent rewiring and lowers the chance of inadvertently causing a misoperation.

Limited Electromagnetic Pulse (EMP) Impact

An EMP can result in strong electric and magnetic fields, which induce voltages and currents on electrical conductors. Having fewer copper conductors in the yard reduces the effects of an EMP on a protection and control system. Fiber-optic cables are immune to EMP-induced currents and voltages, thus limiting an EMP's impact.



Conventional Substation—Miles of copper cables lie between the primary equipment and the control house.



Digital Secondary System—Using fiber-optic cables simplifies the wiring in this configuration.

SEL TiDL Technology—A Simple, Fast, and Secure Solution

SEL TiDL technology has strong cybersecurity and is easy to implement, with no network engineering required. TiDL provides low latency and high availability and is not dependent on an external time reference for synchronization.

To implement a TiDL system, we install SEL-2240 Axion® TiDL nodes in the yard close to primary equipment. These nodes act as field modules to digitize discrete I/O signals and analog data, such as voltages and currents.

In this simple point-to-point architecture, each Axion TiDL node is paired with one of the SEL-400 series TiDL-enabled relays. Relay settings remain the same as those in the present SEL-400 series models, providing consistency and simplicity.

SEL Family of TiDL-Based Products

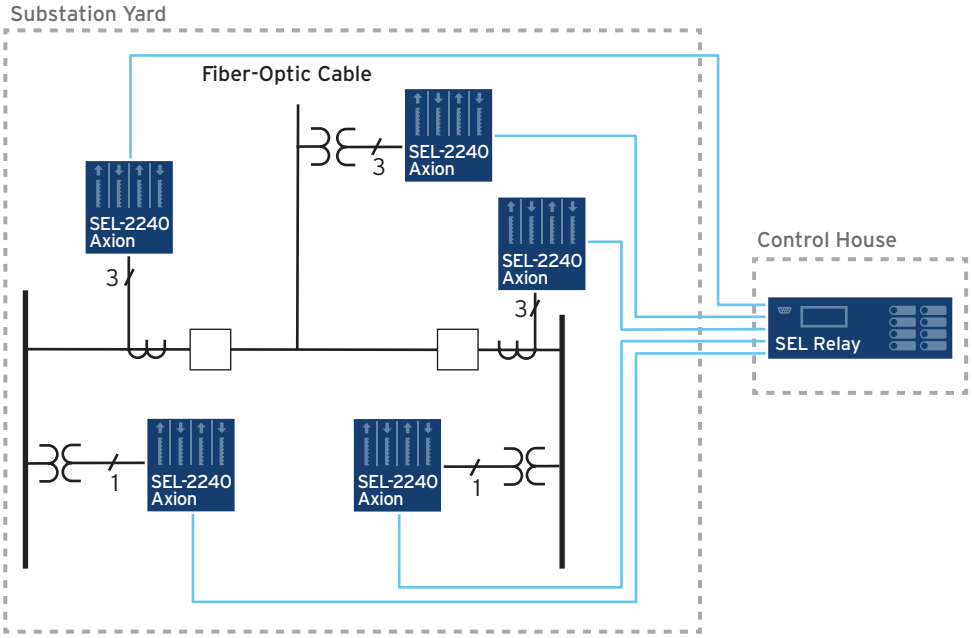
SEL-2240
Axion
(TiDL node)

SEL-421
Protection, Automation, and Control System

SEL-451
Protection, Automation, and Bay Control System

SEL-487B
Bus Differential and Breaker Failure Relay

SEL-487E
Transformer Protection Relay



Benefits

By combining the proven protection of the SEL-400 series relays with the modularity and flexibility of the Axion, TiDL technology provides scalable and flexible solutions to meet your application needs now and in the future as SEL further develops and expands on the technology. SEL TiDL technology provides the following benefits:

Simplified Networking

The implementation process requires zero network engineering, making it a simplicity-focused solution. There is no need to understand complex Ethernet networking, and no network configuration tools are necessary.

Proven Protection

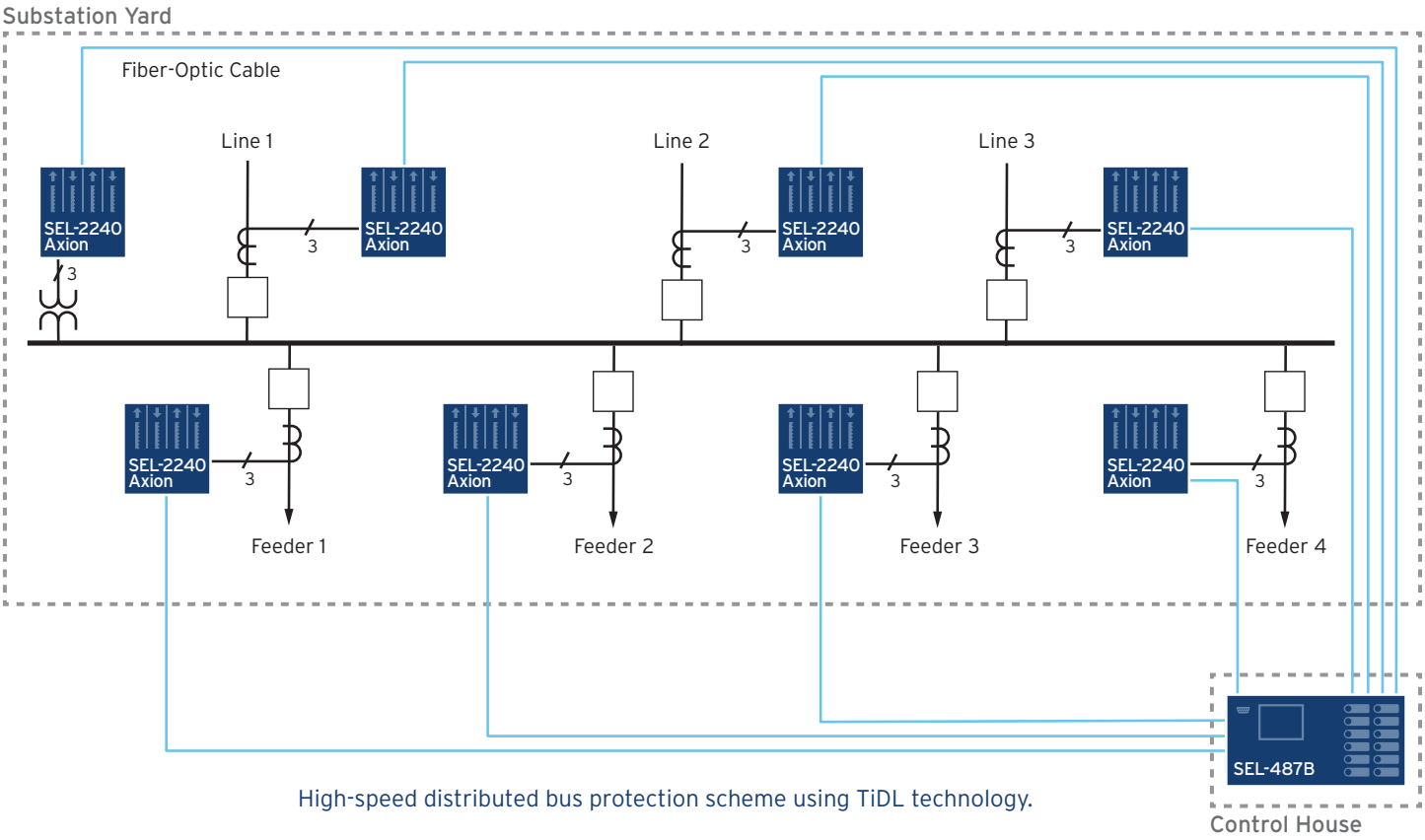
Applying the popular SEL-400 series relays means you can use the same settings, protection schemes, and applications for complete distance, feeder, bus, and transformer protection.

Strong Cybersecurity Posture

The TiDL dedicated, deterministic network keeps mission-critical systems secure. The isolated network and the absence of switches and routers reduce the electronic security perimeter and limit attack points. This security-minded architecture prevents remote access, and its simplicity eliminates the need for managing port access.

Built-In Time Synchronization

A TiDL system maintains relative time, so it does not rely on an external time reference for protection. Remote Axion TiDL nodes all sample synchronously with each other regardless of the number of nodes connected to the network or the length of the fiber used.



High-speed distributed bus protection scheme using TiDL technology.

SEL SV Technology—The Power of IEC 61850 Interoperability

SEL SV is the only solution in the world that combines protection in the merging unit with the flexibility of IEC 61850 SV to increase the reliability of your power system. IEC 61850 supports the creation of a robust, flexible network architecture based on IEC 61850-9-2, the Precision Time Protocol (PTP), and GOOSE messages.

The merging unit digitizes analog signals from primary equipment and then transmits them to the control house via an Ethernet network. The system uses precise time synchronization via IRIG-B or PTP. SEL merging units with protection can be paired with an SEL SV-supported relay or with other products that are compliant with IEC 61850-9-2, offering interoperability in your network.

You can use the SEL-2740S Software-Defined Network Switch to provide centralized traffic engineering and improve Ethernet performance. The switch acts as a transparent PTP clock that supports the IEEE C37.238 power system profile, ensuring submicrosecond time synchronization of the end devices.

Benefits

The SEL SV solution is based on the SEL-400 series product line and uses identical protection algorithms and settings, thus minimizing training requirements. It provides the following benefits:

Interoperability

SEL SV devices are fully compliant with IEC 61850-9-2 and the UCA 61850-9-2LE guideline. You can use them with primary equipment that generates SV streams or with other manufacturers' SV-compliant units.

Flexibility

You can create a robust and flexible Ethernet-based point-to-multipoint network using tools such as software-defined networks or VLANs to fit your application needs.

Local Protection

SEL SV merging units come equipped with breaker control and protection built in. This allows you to have the protection right next to the primary equipment for increased speed and reliability.

SEL Family of SV-Based Products

SEL-401
Protection, Automation, and Control Merging Unit

SEL-421
Protection, Automation, and Control Merging Unit

SEL-421
Protection, Automation, and Control System

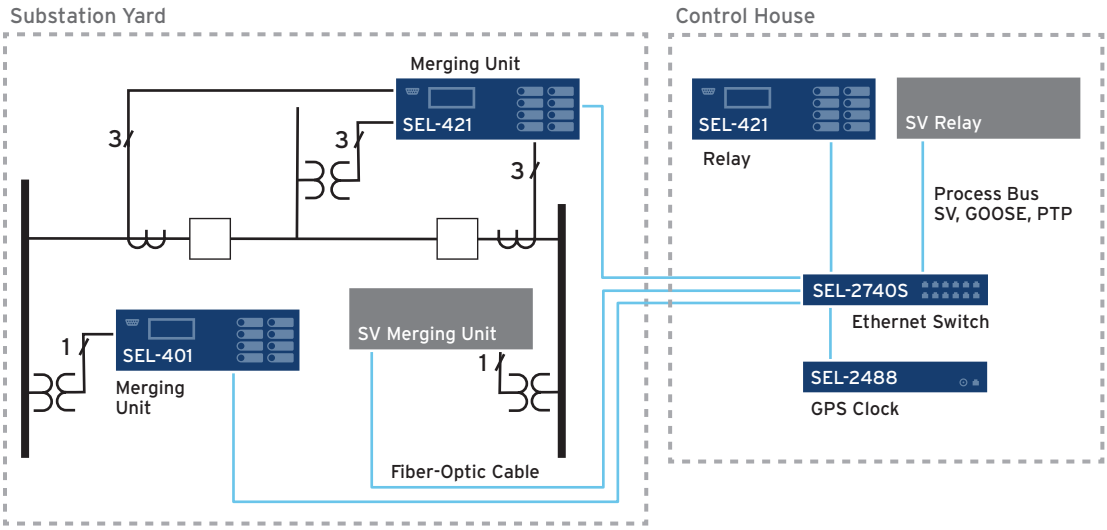
SEL-451
Protection, Automation, and Bay Control System

SEL-487B
Bus Differential and Breaker Failure Relay

SEL-487E
Transformer Protection Relay

SEL-411L*
Advanced Line Differential Protection, Automation, and Control System

*SV support coming soon



A Copper Reduction Solution With the Fastest Protection

SEL Relays in the Substation Yard

All over the world, utilities have placed SEL relays in outdoor cabinets in the substation yard to help achieve copper reduction benefits similar to a digital secondary system solution. This is possible because SEL relays withstand harsh environments while providing unmatched protection. The relays transmit digital data, such as SCADA information, back to the control house via fiber-optic cables.

Benefits

Placing SEL relays in the yard, close to primary apparatus, provides the benefits of a digital secondary system plus the following:

High-Speed Protection

Removing the inherent delay of a communications channel offers faster tripping times when they are needed most.

Reliable Protection

A single device provides protection without relying on a communications channel.

Easy Implementation

There are few to no networking requirements for protection when putting relays in the yard. You follow the same traditional copper wiring practices that have been implemented for decades, making configuration simple and straightforward.

Pick a Solution That Fits Your Needs

	SEL TiDL	SEL SV	SEL Relays in the Yard
Devices Located in Substation Yard	SEL Axion TiDL node	SEL-401 Merging Unit SEL-421 Merging Unit	Any SEL relay
Devices Placed in Control House	SEL-421, SEL-451, SEL-487B, and SEL-487E	SEL-421, SEL-451, SEL-487B, SEL-487E, and SEL-411L* Ethernet switch (e.g., SEL-2740S) Satellite-synchronized clock (e.g., SEL-2488)	N/A
Transport Protocol	IEC 61158 EtherCAT®	IEC 61850-9-2	N/A
Communications Configuration	Point-to-point	Networked	N/A
Sampling Rate	24 kHz	4.8 kHz in 60 Hz system 4.0 kHz in 50 Hz system	Various

*SV support coming soon

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