2025 Product and Solution Guide

New Products

Contents

SEL Innovations Make Electric Power Safer, More Reliable, and More Economical

Traveling-Wave and Time-Domain Technologies

- Protection that isn't dependent on sources; great for areas with high inverter-based resource integration.
- Detects and issues trip commands in 1–2 ms, 5–10 times faster than traditional protection.
- The most accurate fault locator available; pinpoints faults to within one tower span.

Software-Defined Networking

- The only engineered network designed for reliable control system operations.
- Ensures traffic only flows between designated points and blocks all other traffic, eliminating the need for complex firewall rules.
- Redirects network traffic to alternate paths in under 100 µs when the network breaks.

SEL POWERMAX® Power Management and Microgrid Control Solutions

- Maximizes uptime by controlling generation, shedding loads, and automatically synchronizing microgrids.
- Scalable from oil refineries to solar and wind farms to managing an entire country's power system.
- Manages energy costs and determines the optimal generation dispatch based on operational conditions.

SEL Arc Sense™ Technology for Wildfire Mitigation

- Detects and isolates high-impedance downed conductors to reduce fire risk while keeping unaffected line sections energized.
- Alerts operators of a fallen conductor or instructs circuit breakers or recloser controls to isolate the affected circuit.
- Available in many devices already deployed in your distribution systems.

Time-Domain Power Monitoring With Energy Packet Technology

- Streams continuous waveform data to SEL Synchrowave® software, which captures, analyzes, and stores every disturbance.
- Accurately measures energy transfer every millisecond, regardless of the waveshape, frequency, or phase.
- Calculates energy in a simple method that is traceable to the fundamentals of physics and mathematics.

SEL Time-Domain Link (TiDL®) Technology

- The simplest, most reliable, and lowest-cost digital secondary system available.
- Plug-and-operate configuration.
- Requires no network switches or clocks.

SEL ICON® Virtual Synchronous Networking

- Packet transport with deterministic time-division multiplexing (TDM) and better than 1 ms latency.
- Enables TDM-based line current differential protection within IP core networks.
- Allows packet-based and TDM-based systems to work together, greatly reducing communications migration or upgrade costs.

SEL Arc-Flash Solutions

- Life-saving arc-flash protection operates in milliseconds to reduce arc fault energy.
- Combines light sensing with fast overcurrent protection to provide high-speed detection without operating for external faults.
- Works with low- and medium-voltage switchgear and easily coordinates with other devices in industrial- and commercial-scale facilities.

SEL-487E Centralized Protection and Control

- Simplifies commissioning, testing, firmware management, and cybersecurity while reducing the total cost of ownership.
- Built on a proven relay platform.
- Offers flexible deployment solutions, including traditional I/O connections, SEL TiDL, or IEC 61850.

SEL-5702 Synchrowave Operations Software

- Wide-Area Situational Awareness (WASA) software that aggregates time-series data, including synchrophasor data, relay event reports, and high-resolution waveform streams.
- Equips transmission control centers with tools to transform time-synchronized data into detailed system insights that support decision making.
- Simple to use and customizable to maximize WASA.

Blueframe® Data Management and Automation (DMA)

- Automatically collects, stores, and manages device-specific information to simplify system-wide device management and compliance.
- Automates the collection of oscillography, Sequence of Events data, device settings, property information, and other data.
- Rotates passwords and streamlines device audits with summary reports that identify device changes.

Blueframe FLISR (Fault Location, Isolation, and Service Restoration)

- Enables you to create system configurations in minutes with no complex modeling required.
- Manages protection and switching devices at the grid edge, increasing the speed of service restoration.
- Manufacturer-agnostic recloser support through DNP3.

High-Density Coordination™ Solutions for Distribution Protection and Reclosing

- Simplify recloser deployment in any feeder topology, overcoming the limitations of traditional time-overcurrent coordination.
- Coordinate the actions of any number of SEL-651R Advanced Recloser Controls, allowing all of them to operate quickly, securely, and dependably.
- Implement with your existing communications infrastructure—or even without communications.

SEL Grid Configurator Software

- Provides context-oriented configuration and commissioning tools for SEL power system devices.
- Facilitates device testing and commissioning through customized HMI dashboards.
- Simplifies settings evaluation with intuitive comparison interfaces.

ACSELERATOR Architect® SEL-5032 Software

- Provides powerful and simple IEC 61850 configuration.
- Efficiently supports a top-down engineering workflow in the role of the IED Configuration Tool (ICT).
- Innovative interoperability features include the ability to create a custom IED data model and the ability to use multiple IEC 61850 editions in the same system.

About SEL

Our Mission: Making Electric Power Safer, More Reliable, and More Economical

SEL invents, designs, manufactures, and supports a complete line of products and services for the protection, monitoring, control, automation, and metering of electric power systems.

Our solutions range from comprehensive generator and transmission protection to distribution automation and control systems.

Our Engineering Services division partners with customers globally to create turnkey solutions and services that help protect and control critical electrical infrastructure worldwide. We also offer education and full product support.

SEL products are in 172 countries and support industries from petrochemical to transportation to electric utilities.


SEL
SEL
SCHWEITZER
ENGINEERING
LABORATORIES

Dr. Edmund O. Schweitzer, III
Inventor of the world's-first digital protective relay—the SEL-21.

Industries We Serve

- Electric power generation
- Power transmission and distribution
- Oil, gas, and petrochemical
- Renewable energy
- Metals and mining
- Water and wastewater
- Pulp and paper
- Mission-critical power systems
- Government
- Education and healthcare
- Consumer product manufacturing
- Transportation
- Data centers
- Land mobile radio systems

Looking Back, Moving Forward

SEL Founder and Chairman of the Board Dr. Edmund O. Schweitzer, III, invented the first microprocessor-based digital protective relay, the SEL-21, in 1982. The SEL-21 revolutionized the electric power industry by providing reliable transmission line protection with fault locating at a much lower cost than traditional electromechanical relays.

In the decades since, SEL has launched power industry innovations including the load-encroachment element in a transmission relay, synchrophasors as a standard feature in protective relays, and Mirrored Bits® relay-to-relay communications.

2020

We added the SEL-T401L Ultra-High-Speed Line Relay to our family of protective relays, automation controllers, digital secondary system solutions, recloser controls, and more. The SEL-T401L is the first relay in the world to combine traveling-wave and incremental-quantity elements with phasor-based protection.

2021

We released our newest overcurrent protective relay, the SEL-851 Feeder Protection Relay, as well as our operational technology (OT) application platform, Blueframe®, and its first application suite, SEL Data Management and Automation (DMA).

2022

We introduced the SEL-2240 Axion® bay controller, and SEL FLISR (fault location, isolation, and service restoration), a wide-area control application that operates on our Blueframe application platform to locate and isolate faults and automatically restore power to healthy portions of affected lines or feeders.

2023

We made major enhancements to our IEC 61850-based solutions, including a new gigabit Ethernet card for SEL-400 series relays and Parallel Redundancy Protocol (PRP) support for Sampled Values (SV)-based process bus applications.

2024

We released the SEL-TWFL Dual Traveling-Wave Fault Locator and 12-Channel MHz Recorder, which locates faults to within one tower span and monitors up to two transmission lines from a single substation. We also introduced the SEL-T35 Time-Domain Power Monitor, which continuously measures, streams, and records time-synchronized waveform oscillography.

Quality in Manufacturing

We design and manufacture all our electronic devices in the U.S.A. This allows for direct collaboration and short feedback loops between our research and development and manufacturing divisions as well as world-class supply chain security. We manufacture our own critical components, like metal cabinets, printed circuit boards (PCBs), and magnetic devices, in our secure, SEL-owned and -operated facilities in Washington, Idaho, Illinois, and Indiana.

SEL exceeds industry quality standards, requirements, and customer expectations. We test our products thoroughly and verify that they will perform under demanding and harsh conditions.

Our quality practices include:

- Monitoring and controlling processes to exceed the ISO 9001:2015 Quality Management Systems Standard.
- Developing robust, repeatable, and scalable manufacturing processes to address process errors.
- Ensuring that our test and calibration laboratories use the latest equipment and follow National Institute of Standards and Technology (NIST) traceable standards for accuracy and maintenance.
- Partnering with our suppliers for the highest possible quality and value.

Warranty, Service, and Support

We back our products with a ten-year warranty, no-charge diagnostic and repair services, local support, and a variety of test procedures and certifications.

Our dedicated support teams are located in regional offices around the globe and staffed with SEL application engineers who are experts in our products and in power system applications. We offer free, 24/7 emergency technical support for the life of your SEL products.

Many support questions may also be answered by visiting our video portal at video.selinc.com, where you'll find how-to and support videos ranging from product set up and configuration to report retrieval and resource management.

"As an engineering company, we work every day to invent, design, and support products that monitor, control, and protect power systems installed all over the world. Serving our industry is a tremendous privilege and responsibility that we take very seriously. Listening to our customers' requirements and needs, we strive to make our solutions innovative, reliable, easy to use, and secure. We invest in our people, tools, and facilities in order to produce designs that exceed our customers' requirements. Engineering is our middle name, and it's what we love to do."

Dave Whitehead
President

Learn More

Read more about our history, products, and practices at selinc.com/company/about.

SEL Power System Solutions

SEL creates digital products and systems that protect, control, automate, and secure power systems. Our devices help keep power flowing, prevent widespread blackouts, reduce outage durations, improve reliability and safety, and secure equipment, substations, and critical infrastructure.

Generation Systems

Our generation solutions provide primary and backup protection from stator and rotor faults in salient pole and round rotor generators. These devices help prevent equipment damage and failures while maintaining system performance and increasing availability.

Transmission Systems

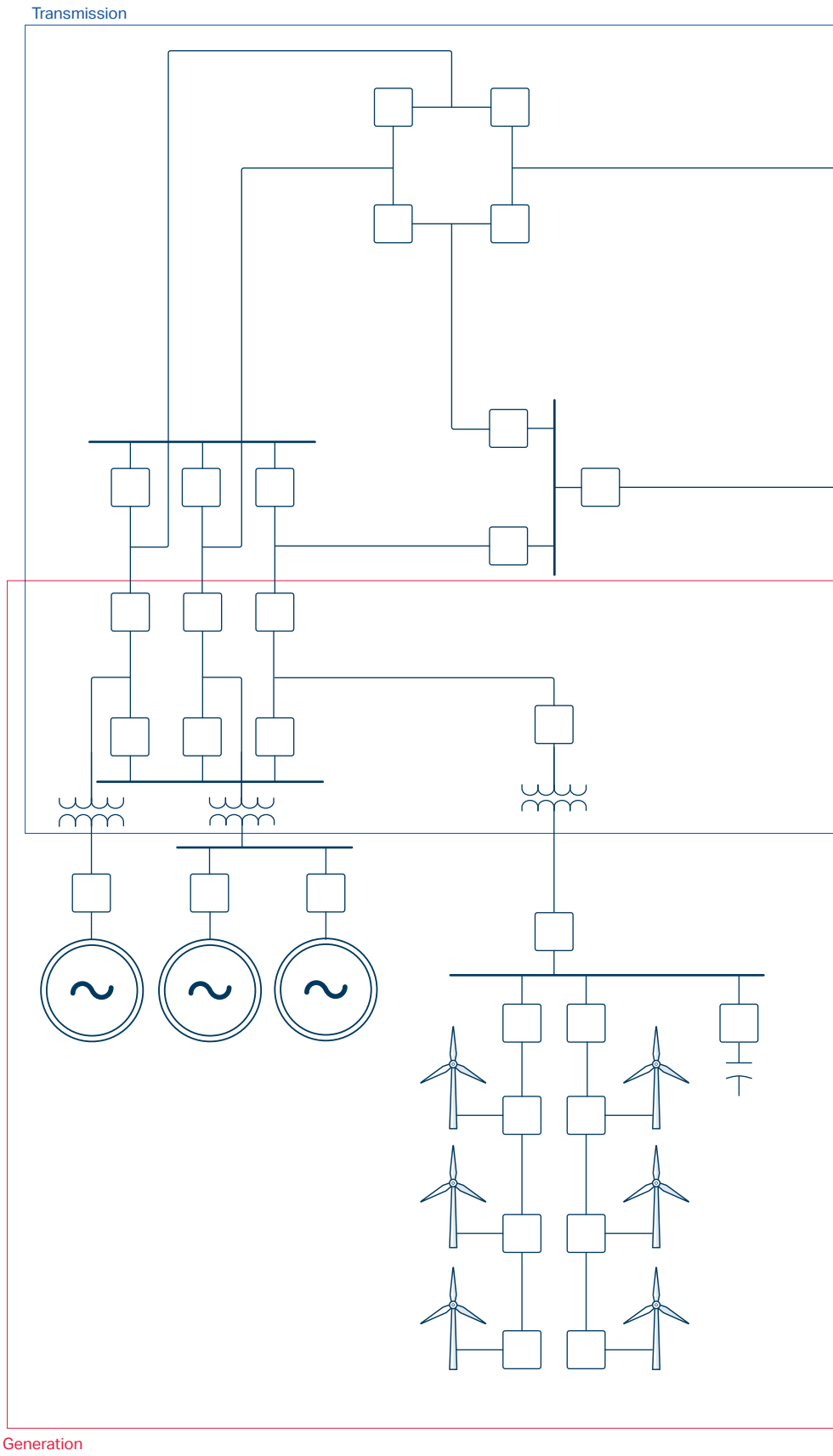
SEL transmission solutions protect high-voltage power lines, transformers, busbars, switchgear, and more. Our devices help reduce outages, speed up restoration times, and pinpoint a fault's location.

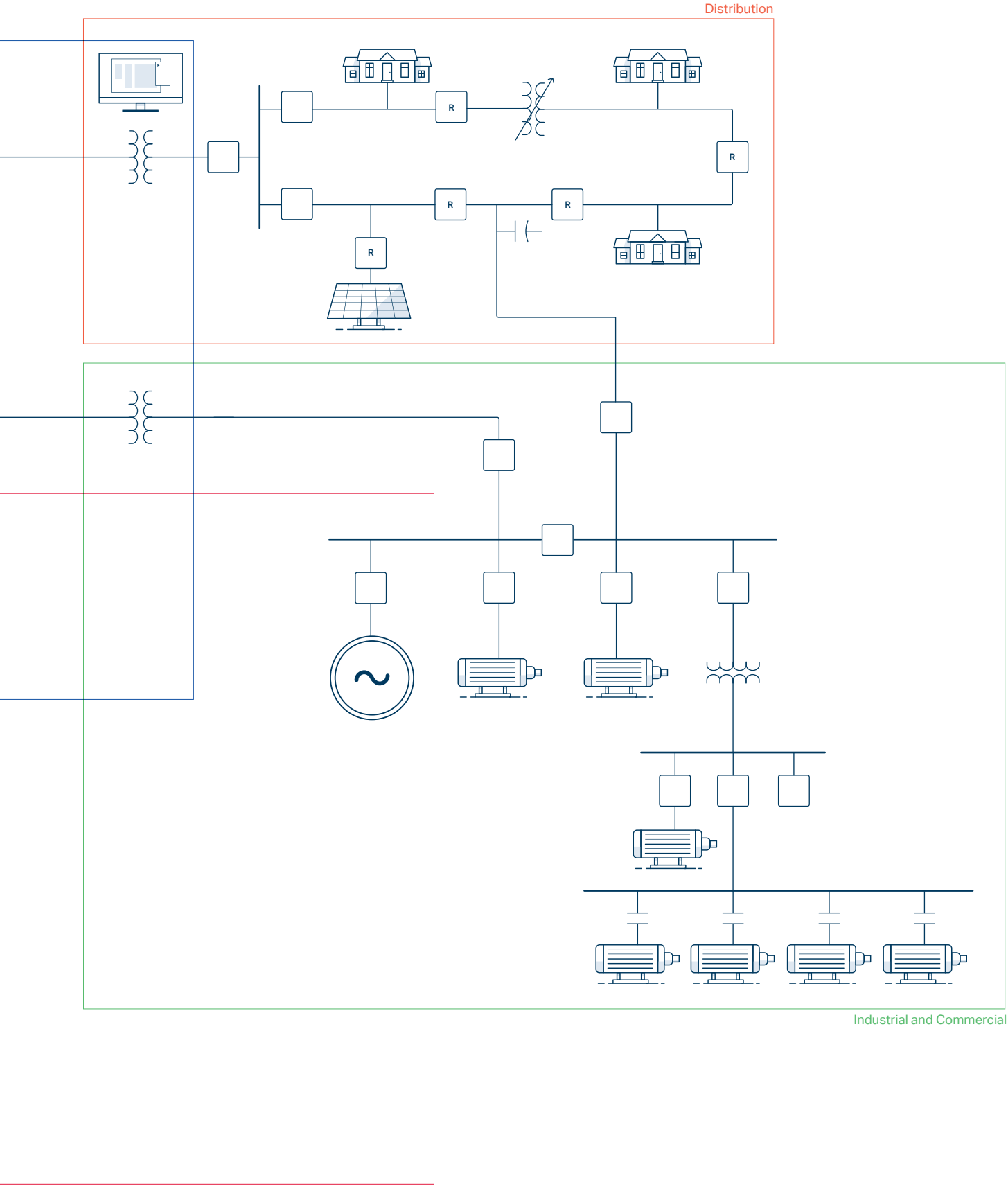
Distribution Systems

Our distribution solutions combine protective relays, recloser controls, communications, automation, and power quality devices. They protect equipment, integrate distributed energy resources, improve reliability metrics, reduce outages, and more.

Industrial and Commercial Systems

For petrochemical, metals and mining, and water and wastewater facilities as well as data centers, hospitals, and universities, SEL offers a wide range of solutions for low- and medium-voltage systems. Our devices protect infrastructure, keep processes online, increase efficiency, and keep workers safe.




Distribution
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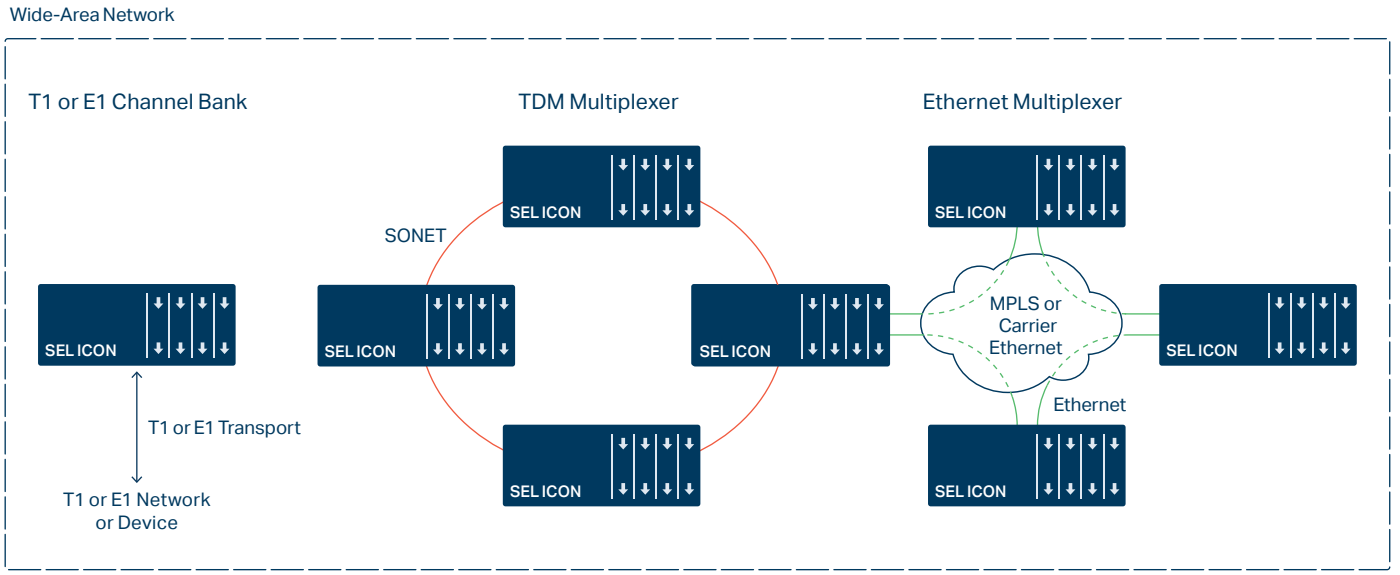
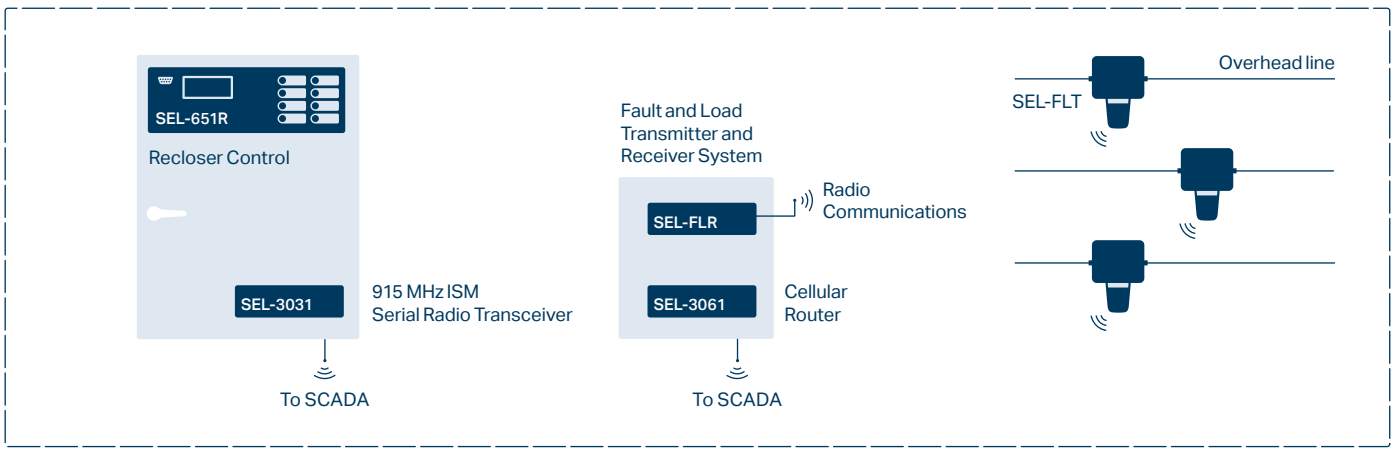
Industrial and Commercial

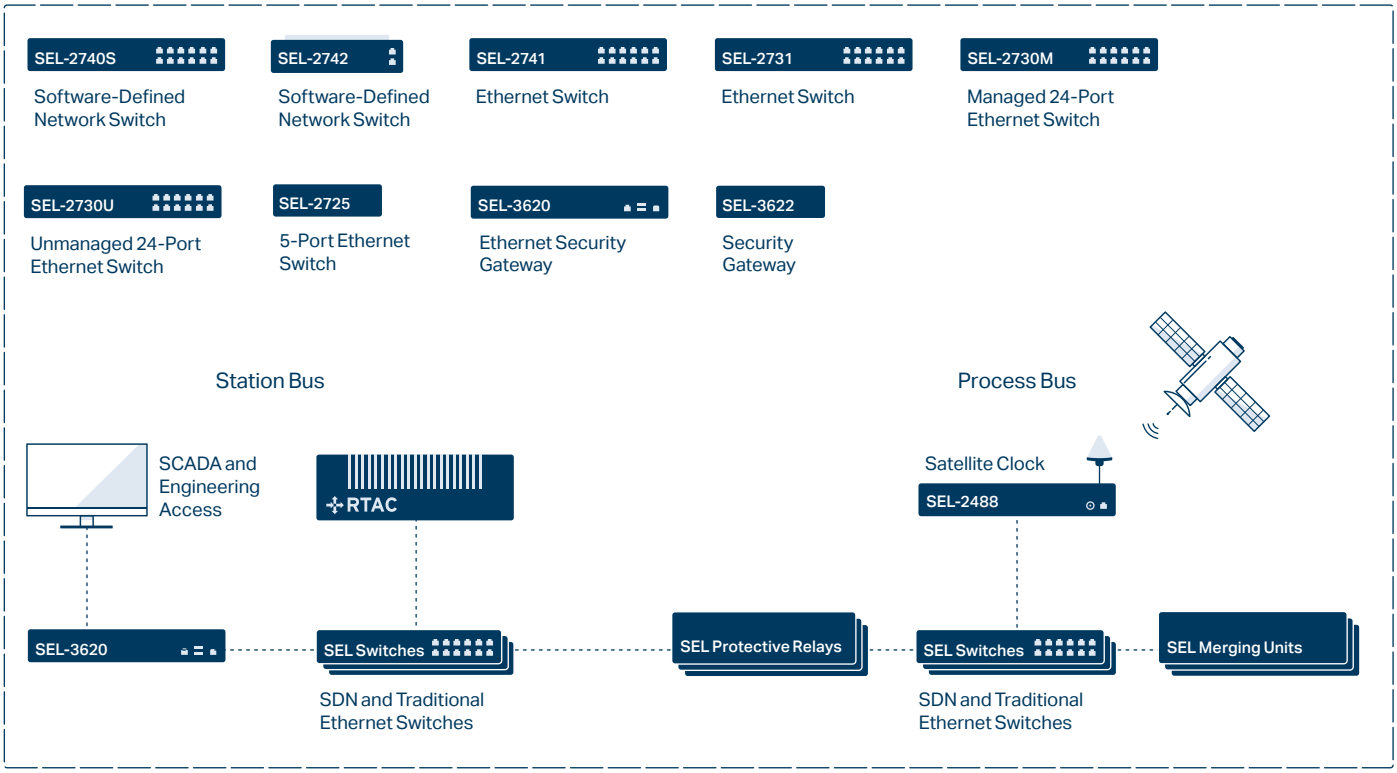
SEL Network Communications

SEL offers a simple, reliable communications architecture to tie together the protection, automation, control, and monitoring devices in a power system network.

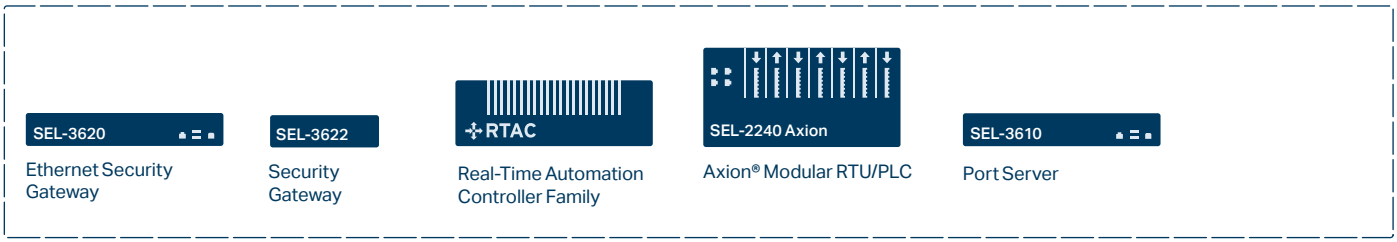




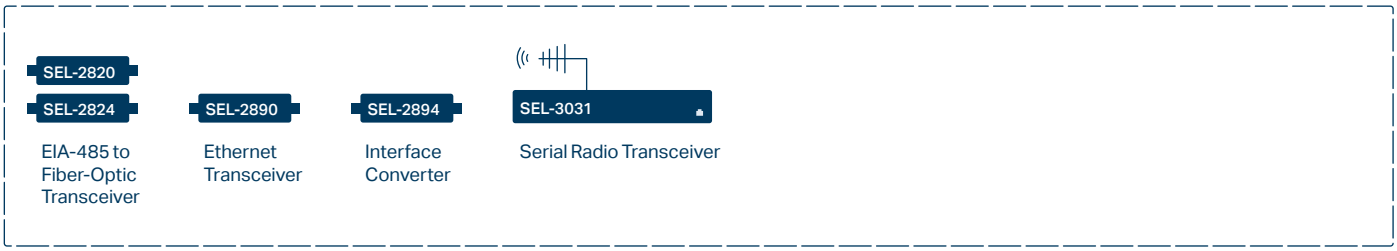
Local-Area Network



Hybrid Communications (Serial, Ethernet, and EtherCAT®)



Serial Communications



Generator Protection

selinc.com/solutions/generation

Modern generators and related equipment require advanced protection, automation, control, metering, and security. SEL products and solutions, including engineering services, address any nameplate rating from megawatt to kilowatt and range from wide-area protection systems down to utility-scale generation and microgrids.

Applications

- Hydropower
- Steam and thermal generation
- Combustion and combined-cycle generation
- Wind power
- Solar power
- Nuclear
- Power management (POWERMAX®)
- Microgrids
- Remedial action schemes/ special protection systems
- Electrical balance-of-plant

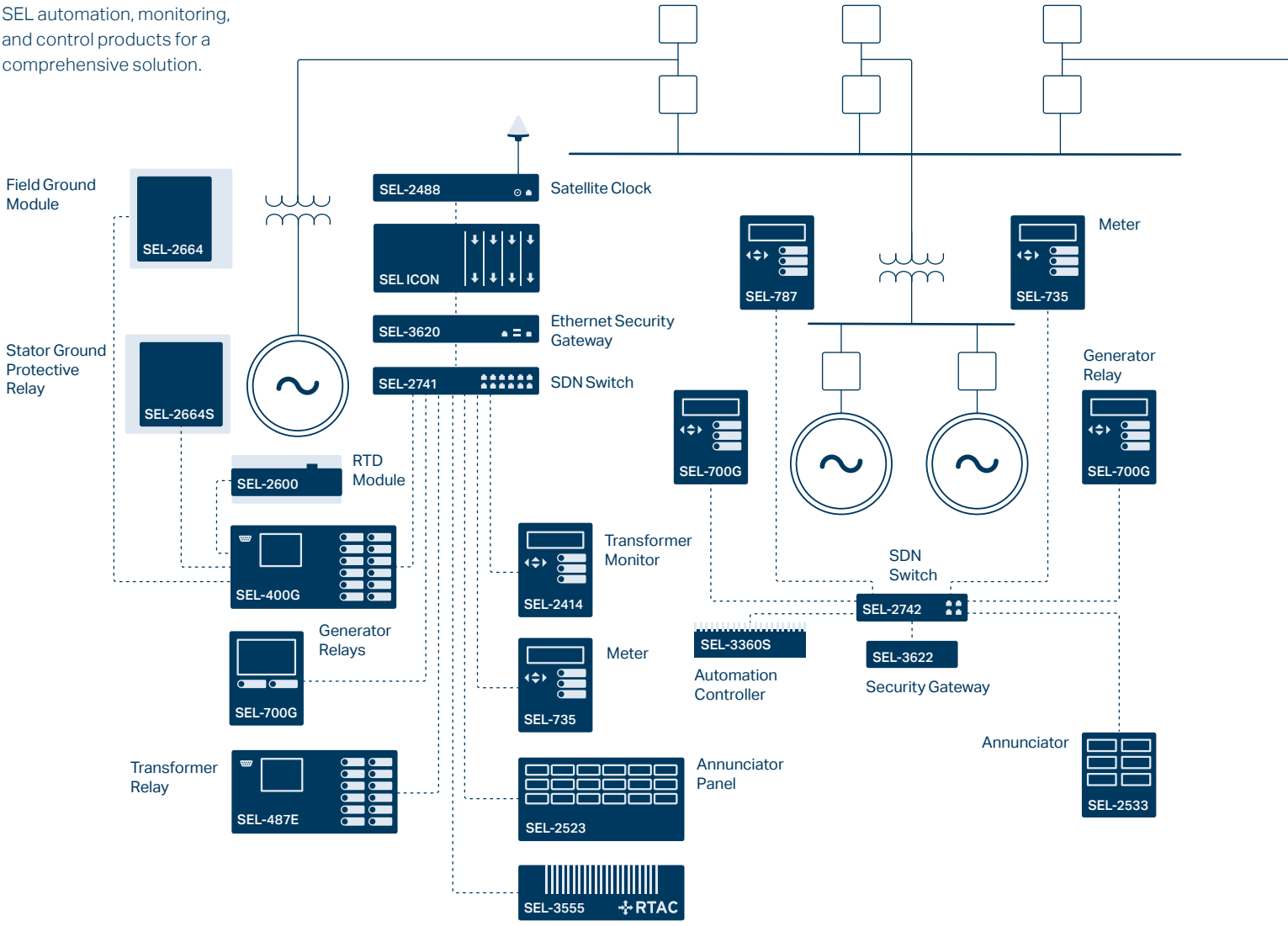
Customer Story

Belgium Integrates Offshore Wind Power Into European Grid

selinc.com/featured-stories/elia

Example System Diagram

Combine SEL generator protective relays with other SEL automation, monitoring, and control products for a comprehensive solution.



Webinar

Protection Advancements to Benefit Generators of All Sizes and Types

selinc.com/events/on-demand-webinar/130607

Related Material

POWERMAX Solutions

selinc.com/api/download/106293

Technical Papers

Wind Farm Volt/VAR Control Using a Real-Time Automation Controller

selinc.com/api/download/99167

Leveraging Digital Relays for Protection of Pumped Storage Hydro

selinc.com/api/download/121666

Capability Curve-Based Generator Protection Minimizes Generator Stress and Maintains Power System Stability

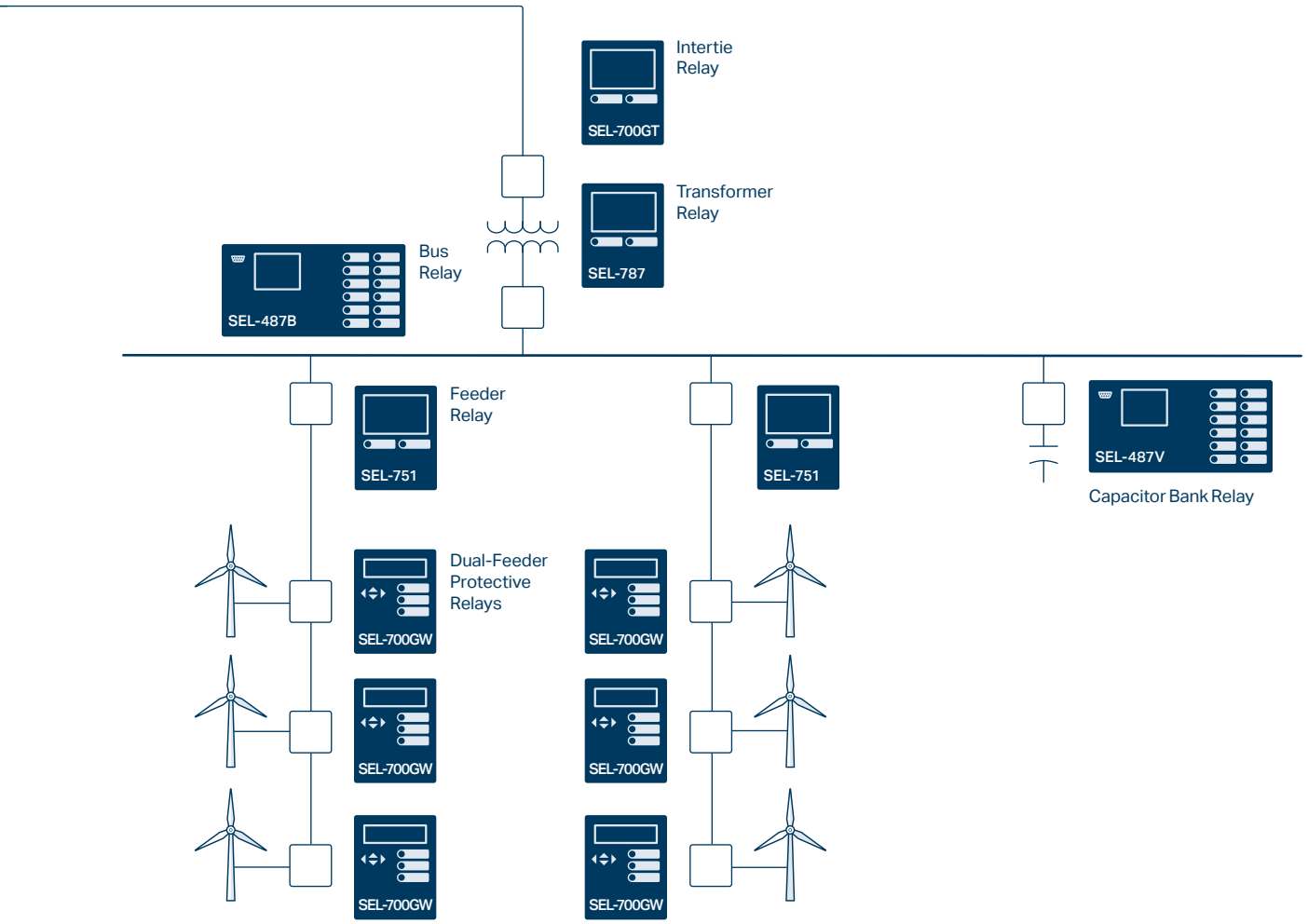
selinc.com/api/download/124333

Stator Ground Protection for Multiple High-Impedance Grounded Generators Sharing a Common Bus

selinc.com/api/download/124321

Understanding Generator Stator Ground Faults and Their Protection Schemes

selinc.com/api/download/111667



SEL-400G Advanced Generator Protection System

Combine generator, bus, and step-up transformer protection in one package, and achieve comprehensive protection and monitoring for generators of all types and sizes, including those used in pumped-storage applications.

SEL-700G Generator Protection Relay

Provide generator or unit protection in utility, industrial, and renewable applications with the flexible I/O and functionality of the compact, economical SEL-700G.

SEL-300G Generator Relay

Implement primary and backup protection for utility and industrial generators.

SEL-2664S Stator Ground Protection Relay

Protect high-impedance grounded generators from ground faults at standstill, during startup, and while running. All SEL-2664S relays are sold with the SEL-4664 Calibration Module.

SEL-2664 Field Ground Module

Combine the SEL-2664 with other SEL generator protective devices to continuously monitor field-to-ground resistance and protect critical components, including rotor and stator windings.

SEL-2600 RTD Module

Measure and transmit data from as many as 12 resistance temperature detector (RTD) inputs and one contact input over a single fiber-optic link.

Applications	SEL-400G	SEL-300G	SEL-700G	SEL-700GT	SEL-700GW
Generator Protection	■	■	■	+	■[1]
Unit/Overall (Generator + Generator Step-Up [GSU]) Differential Protection	■	+	■		
Independent GSU Transformer Protection	■				
Pumped-Storage Hydro Protection	■		■		
Integrated Synchronizer	+		+	+	
Breaker Failure Protection	■	*ƒ*	■	■	■
Equipment Thermal Monitoring	■	+	+	+	+
Generator Intertie Protection				■	

Instrumentation and Control	SEL-400G	SEL-300G	SEL-700G	SEL-700GT	SEL-700GW
SELogic® Control Equations/Remote Control Switches	■	■	■	■	■
Nonvolatile Latch Control Switches	■	■	■	■	■
Multiple Settings Groups	■	■	■	■	■
Station Battery Monitor	■	■			
Breaker Wear Monitor	■	■	■	■	■
Event Report (Multicycle Data)/Sequential Events Recorder	■	■	■	■	■
Disturbance Recording up to 300 seconds	■				
Demand Meter	■	■	■	■	■
Load Profile Report	■		■	■	■
RTD Inputs	+	+	+	+	+
Ethernet	+		+	+	+
Built-In Web Server	+		+	+	+
EtherNet/IP			+	+	+
IEEE 1588 Precision Time Protocol (PTP)	+		+	+	+
IEC 61850 Edition 2	+		+	+	+
IEC 60870-5-103			+	+	+
Parallel Redundancy Protocol (PRP)	+		+	+	+
DNP3 Serial	■		+	+	+
DNP3 LAN/WAN	+		+	+	+
Simple Network Time Protocol (SNTP)	+		+	+	+
Rapid Spanning Tree Protocol (RSTP)			+	+	+
Modbus TCP	+		+	+	+
Modbus RTU Outstation		■	■	■	■
IEEE C37.118 Synchrophasors (With Protocol Edition)	■ 2011		■ 2005	■ 2005	■ 2005
Mirrored Bits® Communications	■		■	■	■

Miscellaneous	SEL-400G	SEL-300G	SEL-700G	SEL-700GT	SEL-700GW
Dual Frequency Zones (Generator and System)	■				
Frequency Tracking Range	5–120 Hz	20–70 Hz	15–70 Hz	15–70 Hz	15–70 Hz
Accepts Wye or Open-Delta Voltage Transformers	■	■	■	■	■
Connectorized® (Quick Disconnect) Available	+	+			

Protection	SEL-400G	SEL-300G	SEL-700G	SEL-700GT	SEL-700GW
21C Compensator Distance		■	+		
21P Phase Mho Distance	■	■			
24 Overexcitation (Volts/Hertz)	■	■	■	+	
25 Synchronism Check	■	+	+	■	
27/59 Under-/Overvoltage	■	■	■	■	
27I/59I Inverse-Time Undervoltage/ Overvoltage	■		■	■	
32 Directional Power	■	■	■	■	
40 Impedance-Based Loss of Field	■	■	■	+	
40 Capability-Based Loss of Field	■				
46 Current Unbalance	■	■	■	+	
46 Harmonic Current Unbalance	■				
49 Thermal Model	■		■	+	
49R Thermal Overload (RTD)	■	■	■	■	■
50 (P,N,G) Overcurrent (Phase, Neutral, Ground)	■	■	■	■	■
50Q Negative-Sequence Overcurrent	■	+	■	■	■
51 (N,G) Time Overcurrent (Neutral, Ground)	■	■	■	■	■
51 (P,Q) Time Overcurrent (Phase, Neg. Seq.)	■	■		■	■
60 Loss of Potential	■	■	■	■	
60 Voltage Balance Loss of Potential	■				
60 (P,N) Independent Split-Phase (Phase, Neutral)	■				
64G 100 Percent Stator Ground	■	■	+		
64G Intermittent Ground Fault Detection	■				
64F Field Ground	■	■	■	+	■
67 (N,G) Directional Overcurrent (Neutral, Ground)	■		■	+	
67Q Negative-Sequence Directional Overcurrent	■			■	
78 Out of Step	■	■	+		
78 Dual Zone (Generator and System) Out of Step With Pole Slip Counters	■				
78VS Vector Shift			■	■	
81 Over-/Underfrequency	■	■	■	■	
81A Accumulated Frequency	■				
81R Rate-of-Change of Frequency	■		■	■	
87 Stator Differential	■	+	+		
Transformer Differential	■				
REF Restricted Earth Fault	■		■	+	
Inadvertent Energization	■	■	■	+	
Flashover Protection	■	*ƒ*	*ƒ*		
Low-Energy Analog (LEA) Current and Voltage Sensors Support			+	+	+

■ Standard feature + Model option *ƒ* May be created using settings

[1]Protects wind collector system apparatus during overcurrent events

Industrial and Commercial Protection

selinc.com/solutions/industrial

SEL power management, protection, automation, and control solutions are hard at work in heavy industries and commercial-scale facilities around the world. These solutions protect low- and medium-voltage equipment and help improve system performance, availability, and process efficiency.

Applications

- Asynchronous (induction) and synchronous motor protection
- Variable-frequency drive protection
- Motor bus transfer systems
- Motor control centers
- Arc-flash mitigation
- Power quality and revenue metering
- Power management and control systems (POWERMAX®)
- Centralized motor management systems (MOTORMAX®)
- Microgrid control systems
- Wide-area protection and remedial action schemes

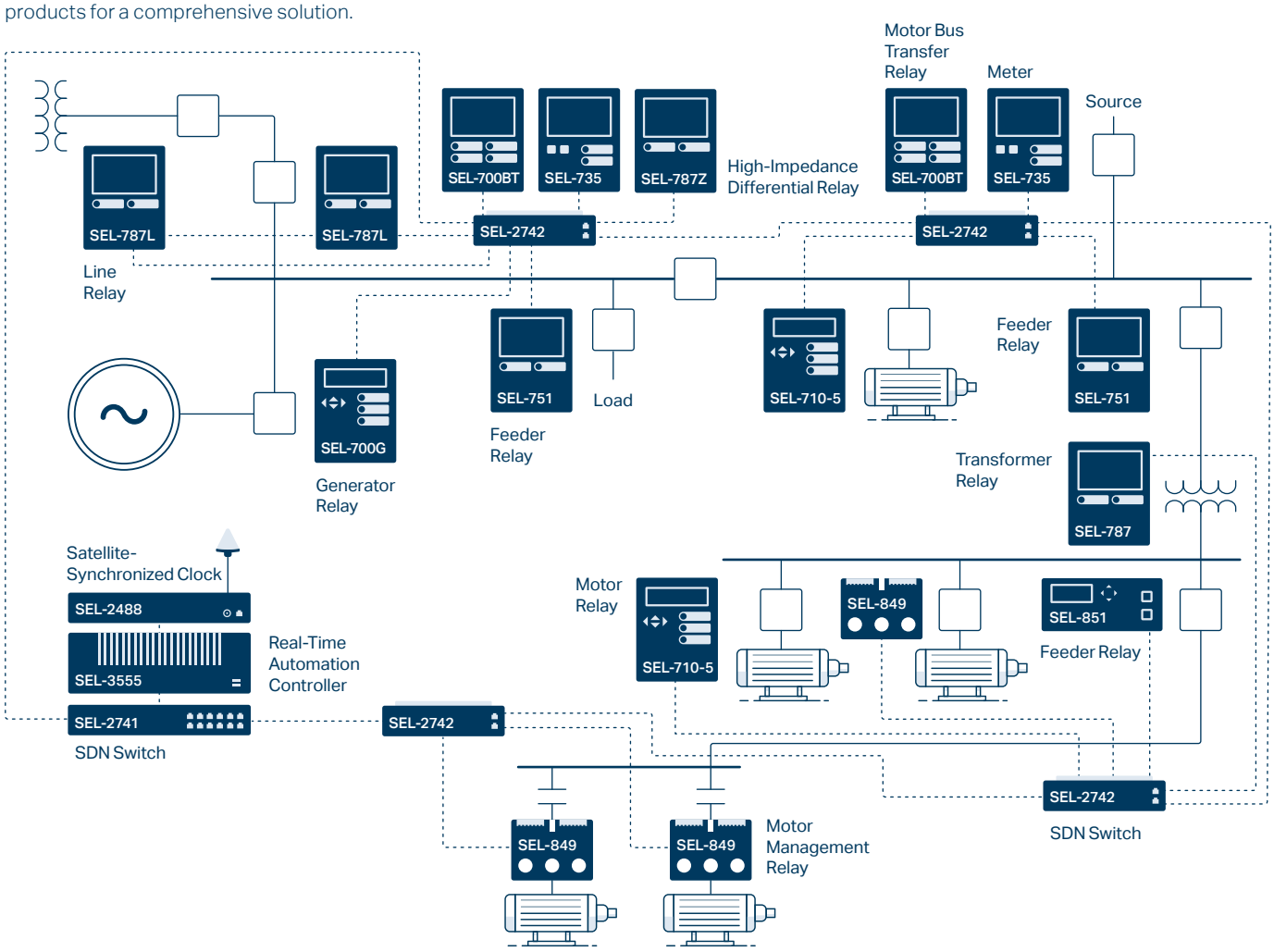
Customer Story

Microgrid Solution Plays Big on Campus

selinc.com/featured-stories/msu

Example System Diagram

Combine SEL's low- and medium-voltage protective relays with other SEL automation, monitoring, and control products for a comprehensive solution.



Webinars

Introducing the SEL-787L Line Current Differential Relay

selinc.com/events/on-demand-webinar/139454

SEL POWERMAX Commercial Microgrids—Sustainable, Economic, and Resilient

selinc.com/events/on-demand-webinar/133374

SEL POWERMAX Power Management and Control System for Industrial Applications (Part 1)

selinc.com/events/on-demand-webinar/132490

Technical Papers

Best Practices for Motor Control Center Protection and Control

selinc.com/api/download/102532

Case Study: Turbine Load-Sharing and Load-Shedding System for an Australian LNG Facility

selinc.com/api/download/128554

Making My Paper Mill Safer: An Arc-Flash Energy Reduction Story

selinc.com/api/download/126387

Case Study: Adaptive Load Shedding in Critical Industrial Facilities

selinc.com/api/download/130119

White Paper

Purpose-Engineered, Active-Defense Cybersecurity for Industrial Control Systems

selinc.com/api/download/121044

Videos

How a Data Center Achieves Utility-Grade Metering

video.selinc.com/detail/videos/case-studies/video/5747812817001

Engineer a Better Network—It Starts With SDN

video.selinc.com/detail/videos/software-defined-networking

SEL-787L Line Current Differential Relay NEW

The SEL-787L is an economical and dependable line current differential protection solution that offers arc-flash protection, fault locating, high-impedance fault detection, and more.

SEL-751 Feeder Protection Relay

The SEL-751 offers feeder protection, an intuitive color touchscreen, fast and secure arc-flash detection, flexible I/O, and advanced communications.

SEL-851 Feeder Protection Relay

The SEL-851 is a compact relay that provides overcurrent, voltage, and arc-flash protection as well as versatile communications.

SEL-700BT Motor Bus Transfer Relay

Ensure motor bus system process continuity by allowing the quick transfer of load to an auxiliary feeder during primary feeder line faults.

SEL-710-5 Motor Protection Relay

Provide protection, including optional arc-flash detection, for a full range of medium-voltage, three-phase induction, and synchronous motors.

SEL-849 Motor Management Relay

Provide current-, voltage-, and thermal-based protection; arc-flash detection; and power metering in low-voltage to medium-voltage motor protection applications.

SEL-700G Generator Protection Relay

Provide standby, emergency, and co-generator protection with an autosynchronizer, flexible I/O, and advanced communications.

SEL-787-2/-3/-4 Transformer Protection Relay

Apply advanced protection and monitoring with flexible communications to two-, three-, and four-terminal transformers.

SEL-587Z High-Impedance Differential Relay

Use the economical SEL-587Z to combine high-impedance analog technology with the advantages of microprocessor technology.

SEL-787Z High-Impedance Differential Relay and SEL-HZM High-Impedance Module

The SEL-787Z combines high-impedance protection principles with advanced numerical technologies to provide high-impedance differential protection. Apply the SEL-787Z and SEL-HZM High-Impedance Module for a comprehensive, single-zone bus-protection solution.

SEL-735 Power Quality and Revenue Meter

SEL meters offer bidirectional, full four-quadrant, and high-accuracy energy metering as well as precise and reliable power quality measurements.

SEL-2600 RTD Module

Measure and transmit data from as many as 12 resistance temperature detector (RTD) inputs and one contact input over a single fiber-optic link.

SEL-2742 Ethernet Switch

The SEL-2742 is a 12-port, DIN-rail mount software-defined networking (SDN) switch. It combines with SEL-5056 Flow Controller software to simplify network engineering and improve LAN security.

SEL-3555 Real-Time Automation Controller (RTAC)

The SEL-3555 provides powerful processing for large-scale automation projects.

SEL-3350 Computing Platform

The SEL-3350 is ideal for limited-space, dedicated embedded applications that require midlevel I/O and computation. It can be configured as a Real-Time Automation Controller (RTAC), as a computer, or with the SEL Blueframe® application platform.

POWERMAX Power Management and Control Systems

For industrial facilities, an SEL POWERMAX system increases process uptime by protecting against blackouts with advanced high-speed protection and control technology. A commercial-scale POWERMAX microgrid control system helps keep the lights on, seamlessly islanding and reconnecting with the bulk electric system.

MOTORMAX Low-Voltage Motor Management and Protection System

MOTORMAX provides comprehensive control, protection, analysis, and monitoring for original equipment manufacturer motor control centers.

Applications	SEL-787L	SEL-751	SEL-851	SEL-700BT	SEL-710-5	SEL-849	SEL-700G	SEL-787-2/-3/-4	SEL-587Z	SEL-787Z
Generator Protection		+					■			
Motor Protection					■	■				
Motor Bus Transfer Protection				■						
Feeder Protection	■	■	■	■		■	+			
Transformer Protection								■		
Bus Differential Protection								■	■	■
Line Current Differential Protection	■									

Protection	SEL-787L	SEL-751	SEL-851	SEL-700BT	SEL-710-5	SEL-849	SEL-700G	SEL-787-2/-3/-4	SEL-587Z	SEL-787Z
24 Overexcitation (Volts/Hertz)							■	+		
27/59 Under-/Overvoltage	+	+	+	■	■	+	■	+		■
32 Directional Power	+	+	+			+	■	+		
37 Underpower					■	+				
46 Current Unbalance				■	■	■	■			
47 Phase Reversal					■	■				
49 Thermal	■	■			■	■	■	■		
49R Thermal Overload (RTD)	+	+		■	+		■			
50 Overcurrent	■	■	■	■	■	■	■	+	■	■
51 Time Overcurrent	■	■	■	■	■	■	■	+	■	■
55 Power Factor	+	+	+		■	+	*ƒ*			
60 Loss of Potential	+	+	+	■	■	+	■			
64F Field Ground							■			
67 (N,G) Directional Overcurrent (Neutral, Ground)	+	+		■			■			
81 Over-/Underfrequency	+	+	+	■	■	+	■	+		

Protection, Continued	SEL-787L	SEL-751	SEL-851	SEL-700BT	SEL-710-5	SEL-849	SEL-700G	SEL-787-2/-3/-4	SEL-587Z	SEL-787Z
87 Current Differential					+		+	■		
87L (P,G,Q) Line Differential	■									
87Z High-Impedance Differential									■	■
REF Restricted Earth Fault							■	+		
Arc-Flash Detection	+	+	+		+	■				+
Separate Neutral Overcurrent	■	■	■	■	■	■	■	+		
Broken Rotor Bar Detection					■					
Low-Energy Analog (LEA) Current and Voltage Sensors Support	+	+			+		+	+		

Instrumentation and Control	SEL-787L	SEL-751	SEL-851	SEL-700BT	SEL-710-5	SEL-849	SEL-700G	SEL-787-2/-3/-4	SEL-587Z	SEL-787Z
Breaker Wear Monitoring	■	■		■	■		■	■		
RTD Inputs	+	+		+	+		+	+		
IEC 61850 Edition 2	+	+	+	+	+		+	+		+
Parallel Redundancy Protocol (PRP)	+	+		+	+	■	+	+		+
DNP3 Serial	+	+	+	+	+	+	+	+		+
DNP3 LAN/WAN	+	+	+	+	+	+	+	+		+
Simple Network Time Protocol (SNTP)	+	+	■	+	+	■	+	+		+
Built-In Web Server	■	■	■	■	+	■	+	■		■
IEEE 1588 Precision Time Protocol (PTP)	+	+		+	+		+	+		+
EtherNet/IP	+	+		+	+	+	+	+		+
Modbus TCP	+	+	■	+	+	+	+	+	■	+
Modbus RTU Outstation	■	■	■	■	■	■	■	■	■	■
Rapid Spanning Tree Protocol (RSTP)	+	+		+	+		+	+		+

■ Standard feature + Model option *ƒ* May be created using settings

Transmission Line Protection and Fault Locating

selinc.com/solutions/transmission

SEL transmission line protective relays provide reliable subcycle line current differential and multizone distance protection. Their fault-locating capabilities allow you to efficiently dispatch line crews to quickly isolate line problems and restore service faster.

Applications

- Time-domain line protection
- Differential protection
- Pilot protection: directional and distance
- Step distance protection
- Single-pole tripping
- Series-compensated lines
- Single- and dual-breaker terminals

Technical Papers

Modern Line Current Differential Protection Solutions

selinc.com/api/download/6390

Transmission Line Protection System for Increasing Power System Requirements

selinc.com/api/download/2603

A Fresh Look at Limits to the Sensitivity of Line Protection

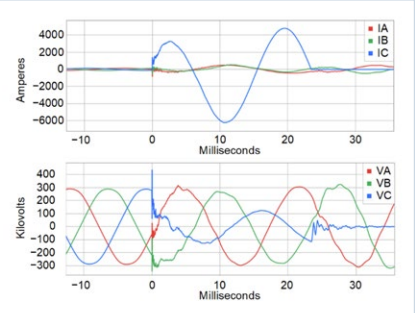
selinc.com/api/download/8505

Series Compensation, Power Swings, and Inverter-Based Sources and Their Impact on Line Current Differential Protection

selinc.com/api/download/21474837052

Speed of Line Protection – Can We Break Free of Phasor Limitations?

selinc.com/api/download/106193



Real-World Event Reports

Field Experiences With Traveling-Wave Protection and Fault Locating

selinc.com/mktg/122973

Webinar

Detecting and Locating a Broken Conductor Before It Converts Into a Fault

selinc.com/events/on-demand-webinar/136022

SEL-T401L Ultra-High-Speed Line Relay

Apply the SEL-T401L, which was built on the field experience of the SEL-T400L, for its unprecedented operating speed and complete suite of primary and backup line protection functions. The SEL-T401L can trip within 1 ms, records events with a 1 MHz sampling rate, locates faults to the nearest tower, and uses line monitoring to detect and locate incipient and recurring faults.

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

Apply the SEL-411L for comprehensive line differential protection for up to four terminals; subcycle distance protection; and directional overcurrent protection. Use traveling-wave fault locating to pinpoint faults to the nearest tower span. Broken conductor detection logic can identify line breaks on overhead conductors.

SEL-421 Protection, Automation, and Control System

Apply the SEL-421 for subcycle distance and directional overcurrent protection.

SEL-9L Line Relay NEW

Use the SEL-9L for comprehensive line protection on single- or dual-breaker subtransmission lines. Universal hardware, modern communications and cybersecurity, and flexible firmware options enable you to tailor the relay to your application.

SEL-311L Line Current Differential Protection and Automation System

Use the SEL-311L for comprehensive, easy-to-apply line differential and four-zone distance protection.

SEL-311C Transmission Protection System

Apply the SEL-311C-1 for three-pole distance protection, reclosing, monitoring, and control of breakers on transmission lines. Apply the SEL-311C-2/-3 for single-pole tripping.

SEL-TWFL Dual Traveling-Wave Fault Locator and 12-Channel MHz Recorder NEW

Use the SEL-TWFL alongside existing line protective relays to locate faults and monitor two line terminals at a substation.

SEL-T4287 Traveling-Wave Test System

Test traveling-wave fault locators and line protective relays (e.g., the SEL-T401L and SEL-411L) using the SEL-T4287, a simple and compact secondary pulse injection test set.

Applications	SEL-T401L	SEL-411L	SEL-421	SEL-311C	SEL-311L	SEL-9L
Pilot Protection—Directional	■	■	■	■	■	■
Pilot Protection—Directional and Distance	■	■	■	■	■	■
Differential Protection	■	■			■	
Step Distance Protection	■	■	■	■	■	■
Single-Pole Tripping	■	■	■	■	■	
Series-Compensated Lines	■	+	+			
Dual-Breaker Terminals	■	+	■			■

Major Protection Functions						
Phase Distance—Mho	4	5	5	4	4	4
Ground Distance—Mho	4	5	5	4	4	4
Phase Distance—Quadrilateral	4	5	5	4	4	4
Ground Distance—Quadrilateral	4	5	5			4
Subcycle Distance Operation	■	+	+	■		+
Nondirectional Distance Zone	1					1
Step Distance Timers	5	5	5	4	4	5
Incremental-Quantity Distance	■					
Directional[1]	■	■	■	■	■	■
Incremental-Quantity Directional	■					
Traveling-Wave Directional	■					
POTT	■	■	■	■	■	■
DCB	■	■	■	■	■	■
DCUB	ƒ	■	■	■	■	ƒ
DTT	■	■	■	■	■	■
Line Current Differential		■			■	
Traveling-Wave Line Current Differential	■					
Instantaneous Overcurrent[1]	4	4	4	4	4	6
Inverse-Time Overcurrent[1]	4	10	10	4	4	6
Definite-Time Overcurrent[1]	4	4	4	4	4	6
Switch Onto Fault	■	■	■	■	■	■
Breaker Failure		■	■	■	ƒ	■
Overvoltage	■	■	■	■	■	■
Undervoltage	■	■	■	■	■	■
Frequency		■	■	■	■	■
Thermal		■	■			ƒ
Out of Step	■	■	■	■	■	■

Supervisory Elements	SEL-T401L	SEL-411L	SEL-421	SEL-311C	SEL-311L	SEL-9L
Loss of Potential	■	■	■	■	■	■
Load Encroachment	■	■	■	■	■	■
Power Swing Blocking	■	■	■	■	■	■
Synchronism Check		■	■	■	■	■

Control						
Automatic Reclosing		■	■	■	■	■
SELOGIC® Control Equations	■	■	■	■	■	■
Nonvolatile Latch Control Switches	■	■	■	■	■	■
SELOGIC Remote and Local Control Switches	■	■	■	■	■	■
Programmable Math Operations		■	■			■

Fault Locating, Monitoring, and Recording						
Fault Locating—Single-Ended Impedance	■	■	■	■	■	■
Fault Locating—Multi-Ended Impedance	■	■				■
Fault Locating—Single-Ended Traveling Wave	■					
Fault Locating—Multi-Ended Traveling Wave	■	+				
Broken Conductor Detection		+				
Breaker Wear Monitor		■	■	■	■	
Substation Battery Monitor		■	■	■	■	■
Trip Coil Monitor		ƒ	ƒ	ƒ	ƒ	■
DC Current Circuit Monitoring Outputs						3
Event Recorder (DFR)	■	■	■	■	■	■
Sequential Events Recorder (SER)	■	■	■	■	■	■
High-Resolution (1 MHz) Event Recorder	■					
Metering	■	■	■	■	■	■

■ Standard feature + Model option ƒ May be created using settings

[1]Phase, negative sequence, and zero sequence

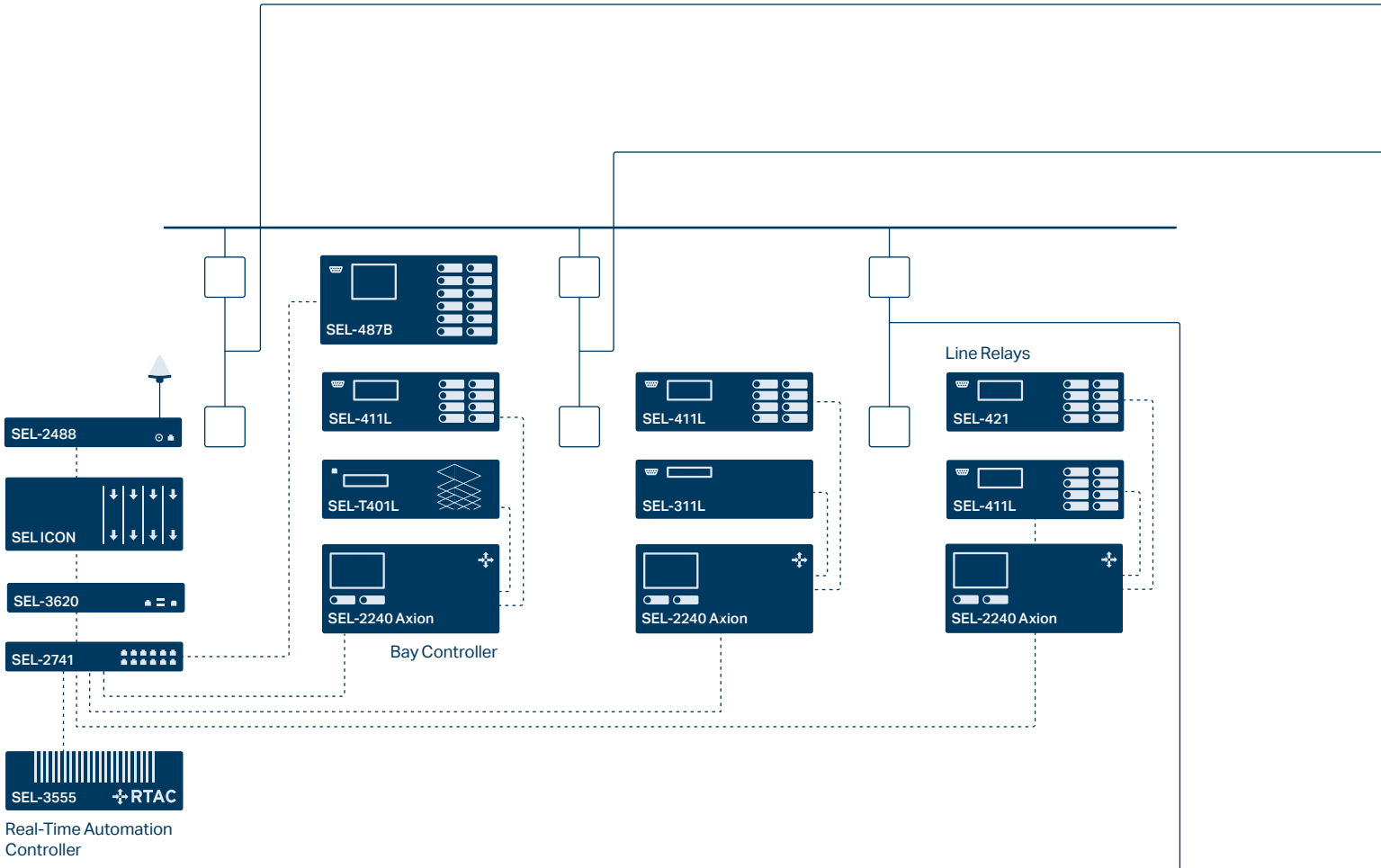
SCADA/HMI Integration and Protocols	SEL-T401L	SEL-411L	SEL-421	SEL-311C	SEL-311L	SEL-9L
SEL ASCII, Fast Meter, and Fast SER	■	■	■	■	■	
DNP3 Serial		■	■	■	■	
DNP3 LAN/WAN	■	■	■	■		■
Synchrophasors (IEEE C37.118)		■	■	■		
IEC 61850		+	+	+	+	+
Parallel Redundancy Protocol (PRP)		■	■	■		■
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)		+	+			+
IEC 61850-9-2 Sampled Values		+	+			+
Time-Domain Link (TiDL®)		+	+			
SEL Fast Time-Domain Values (1 MHz Sampling Rate Streaming)	■					

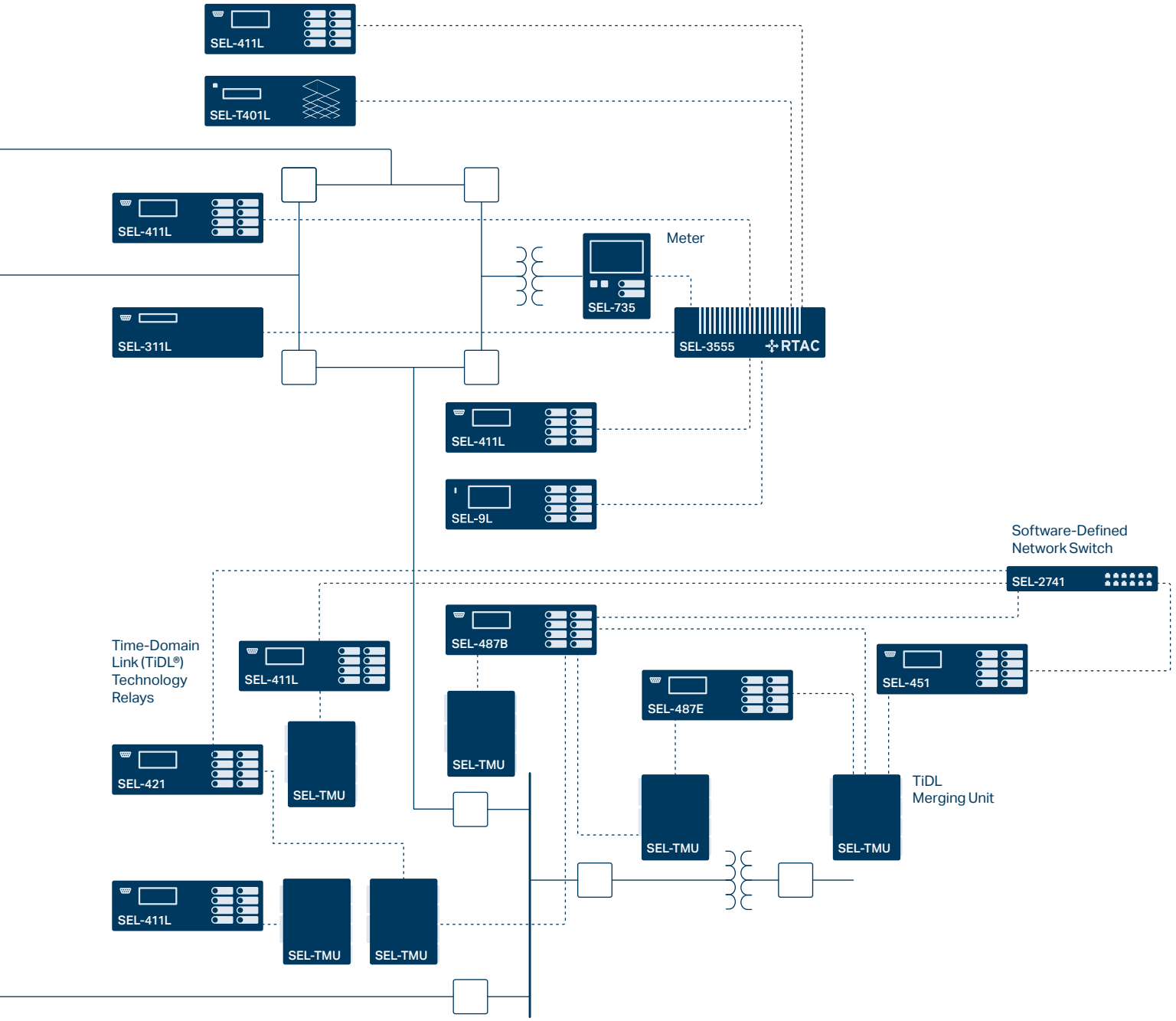
Digital Protection Signaling						
Direct Fiber	■	■		■	■	■
SEL Mirrored Bits®	■	■	■	■	■	■
IEEE C37.94	■	■			■	■

Miscellaneous						
Trip-Rated High-Speed Outputs	■	■	■	■	■	■
Advanced Trip Circuit Monitoring						■
Software-Invertible CT Polarities		■	■			■
Built-In Playback Test	■					
Display Points		■	■	■	■	■
Configurable Targets		■	■	■		■
Front USB-C Port						■
Programable Pushbuttons		12	12			10
Programable Contact Inputs, 24–250 V						■
Programable 1 A/5 A CTs						■
Printable Labels	■	■	■	■		■
Protection With Delta-Connected Voltages				■		

■ Standard feature + Model option

Example System Diagram
Combine SEL transmission protective relays with other SEL automation, monitoring, and control products for a comprehensive solution.




SEL-411L
SEL-T401L
SEL-411L
Meter
SEL-735
SEL-311L
SEL-3555
RTAC
SEL-411L
SEL-9L
Software-Defined
Network Switch
SEL-2741
SEL-487B
Time-Domain
Link (TiDL®)
Technology
Relays
SEL-411L
SEL-451
SEL-487E
SEL-TMU
SEL-421
SEL-TMU
TiDL
Merging Unit
SEL-TMU
SEL-TMU
SEL-411L
SEL-TMU
SEL-TMU

Substation Protection

selinc.com/products/transmission/protection | selinc.com/products/distribution/protection

SEL devices protect, monitor, and control critical assets located in all types of generation, transmission, and distribution substations.

Applications

- Transformer protection and monitoring
- Bus protection
- Breaker failure protection
- Capacitor bank protection
- Digital secondary systems that use Time-Domain Link (TiDL®) or IEC 61850 technologies

Webinars

Protect Multiple Substation Assets Using One Relay: CPC Solutions With the SEL-487E

selinc.com/events/on-demand-webinar/139281

Innovation in IEC 61850 Digital Secondary Systems

selinc.com/events/on-demand-webinar/137779

Technical Papers

Considerations for Using High-Impedance or Low-Impedance Relays for Bus Differential Protection

selinc.com/api/download/5562

Beyond the Nameplate—Selecting Transformer Compensation Settings for Secure Differential Protection

selinc.com/api/download/114458

Beyond the Nameplate: Transformer Compensation Revisited—New Applications, Greater Simplicity

selinc.com/api/download/138123

Performance of IEC 61850 Sampled Values Relays for a Real-World Fault

selinc.com/api/download/137357

Redundant Bus Protection Using High-Impedance Differential Relays

selinc.com/api/download/121745

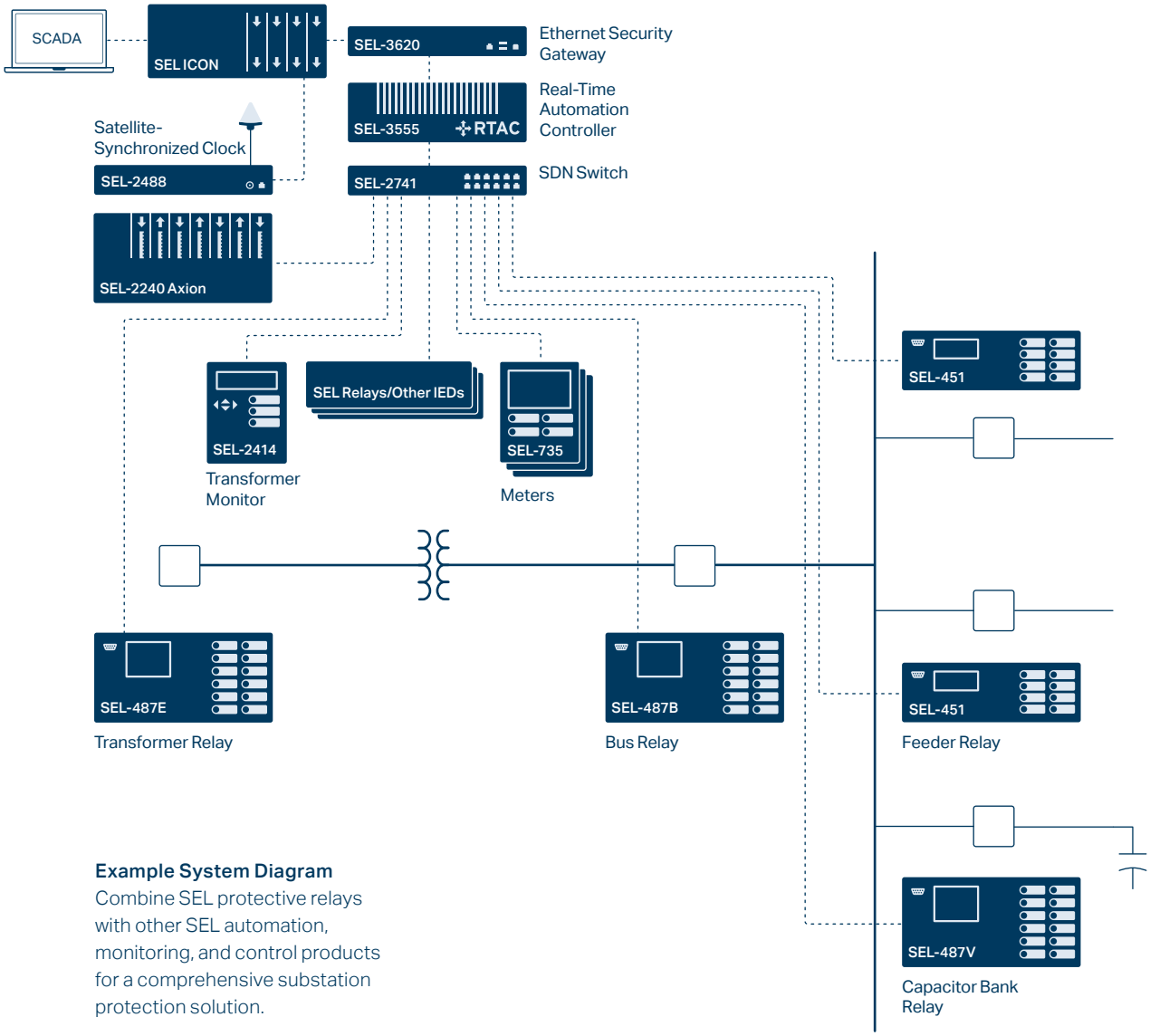
Principles of Shunt Capacitor Bank Application and Protection

selinc.com/api/download/6395

Customer Story

Creating a Better Future: Innovative Substation Modernization in the Philippines

selinc.com/highlights/davao-light



Example System Diagram
Combine SEL protective relays with other SEL automation, monitoring, and control products for a comprehensive substation protection solution.

SEL-352 Breaker Failure Relay

Provide breaker failure protection and breaker control and monitoring with unparalleled flexibility. Point-on-wave opening and closing technology extends breaker life and reduces system transients and restrikes.

SEL-2414 Transformer Monitor

Provide standalone or distributed monitoring and control for new and existing transformers using the optional color touchscreen display.

SEL-787-2/-3/-4 Transformer Protection Relay

Apply advanced protection and monitoring with flexible communications to two-, three-, and four-terminal transformers.

SEL-TMU TiDL Merging Unit

Employ the SEL-TMU for remote data acquisition in substations with Time-Domain Link (TiDL) technology systems. It can share data with up to four SEL-400 series TiDL relays.

SEL-401 Protection, Automation, and Control Merging Unit

Apply merging units in substations with IEC 61850-9-2 Sampled Values (SV) systems. The SEL-401 is a standalone merging unit with phase overcurrent and breaker failure protection. Some SEL SV relays can be configured as merging units to provide local protection that also publishes SV data.

SEL-787Z High-Impedance Differential Relay and SEL-HZM High-Impedance Module

The SEL-787Z combines high-impedance protection principles with advanced numerical technologies to provide high-impedance differential protection. Apply the SEL-787Z and SEL-HZM High-Impedance Module for a comprehensive, single-zone bus-protection solution.

SEL-487B Bus Differential and Breaker Failure Relay

Provide bus differential and breaker failure protection, automation, and control in applications with up to seven terminals per relay. Use multiple SEL-487B relays to expand up to 21 protected terminals for scalable protection and control.

SEL-487E Transformer Protection Relay

Provide high-speed transformer differential protection as well as advanced monitoring, metering, automation, and control. With optional distance, second differential zone, and reclosing functionalities, use the SEL-487E for centralized protection and control applications.

SEL-487V Capacitor Protection and Control System

Protect and control grounded and ungrounded, single- and double-wye capacitor bank configurations.

Transformer Protection and Monitoring

Applications	SEL-487E	SEL-387E	SEL-387	SEL-387A	SEL-787	SEL-787-2X/-21/-2E	SEL-787-3E/-3S/-4X	SEL-587	SEL-2414
Breaker Failure Protection	■	*ƒ*	*ƒ*	*ƒ*	■	■	■	*ƒ*	*ƒ*
Percentage-Restrained Current Differential	■	■	■	■	■	■	■	■	
Number of Differential Zones	1 or 2+	1	1	1	1	1	1	1	
Underfrequency Load Shedding	■	*ƒ*			+	+	+		
Undervoltage Load Shedding	■	*ƒ*			+	+	+		
Three-Phase Current Inputs	6	3	4	2	2	2*	3 or 4	2	2*
Three-Phase Voltage Inputs	2	1			1*	1*	1*		1*

Protection	SEL-487E	SEL-387E	SEL-387	SEL-387A	SEL-787	SEL-787-2X/-21/-2E	SEL-787-3E/-3S/-4X	SEL-587	SEL-2414
21 Phase and Ground Distance	+								
24 Overexcitation (Volts/Hertz)	■	■			+	+	+		
25 Synchronism Check	■						+		
27/59 Under-/Overvoltage	■	■			+	+	+		
32 Directional Power	■				+	+	+		
46 Current Unbalance	■								
49 Equipment Thermal Monitoring	■		+	■	■	■	■		
50FO Flashover Protection	*ƒ*	*ƒ*			*ƒ*	*ƒ*	*ƒ*		
50 (N,G) Overcurrent (Neutral, Ground)	■	■	■	■	■	■	■	■	
50P Phase Overcurrent, 50Q Negative-Sequence Overcurrent	■	■	■	■	■	■	■	■	
51 (N,G) Time Overcurrent (Neutral, Ground)	■	■	■	■	■	■	■	■	
51P Phase Time Overcurrent	■	■	■	■	■	■	■	■	
51Q Negative-Sequence Time Overcurrent	■	■	■	■	■	■	■	■	
67 (P,G,Q) Directional Overcurrent (Phase, Ground, Negative Sequence)	■								
81 Under-/Overfrequency	■	■			+	+	+		
81R Rate-of-Change of Frequency	*ƒ*								
87 Current Differential	■	■	■	■	■	■	■	■	
REF Restricted Earth Fault	■	■	■	+	+	+	■		

Instrumentation and Control	SEL-487E	SEL-387E	SEL-387	SEL-387A	SEL-787	SEL-787-2X/-21/-2E	SEL-787-3E/-3S/-4X	SEL-587	SEL-2414
SELOGIC® Control Equations	■	■	■	■	■	■	■	■	■
Voltage Check on Closing	*ƒ*	*ƒ*			*ƒ*	*ƒ*	*ƒ*		
Transformer Cooling Fan Control	*ƒ*				*ƒ*	*ƒ*	*ƒ*		■
Nonvolatile Latch Control Switches	■	■	■	■	■	■	■		■
SELOGIC Remote Control Switches	■	■	■	■	■	■	■	■	■
SELOGIC Local Control Switches	■	■	■	■	■	■	■		■
Display Points	■	■	■	■	■	■	■		■
Multiple Settings Groups	■	■	■	■	■	■	■		
Substation Battery Monitor	■	■	■	■		+	+		*ƒ*
Breaker Wear Monitor	■	■	■	■		■	■		
Event Report (Multicycle Data)	■	■	■	■	■	■	■	■	■
Sequential Events Recorder	■	■	■	■	■	■	■		■
Instantaneous and Demand Meter	■	■	■	■	■	■	■	■	■
Load and Temperature Profile Report	■				■	■	■		■
RTD (Resistance Temperature Detector) Inputs					+	+	+		+
Built-In Web Server	■	■				+	+		
Software-Invertible Polarities	■								
IEC 60255-Compliant Thermal Model	■								
IEEE C37.118 Synchrophasors	■				■	■	■		
IEC 61850	+	+			+	+	+		+
IEC 61850-9-2 Sampled Values Technology	+								
Simple Network Time Protocol (SNTP)	■				+	+	+		■
Parallel Redundancy Protocol (PRP)	■					+	+		■
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)	+					+	+		■
EtherNet/IP						+	+		
Time-Domain Link (TiDL) Technology	+								
Through-Fault Monitor	■	■	+	■	■	■	■		■
Thermal Model/SEL-2600 RTD Module Communications	■		+	■	■	■	■		■

■ Standard feature + Model option

ƒ May be created using relay elements, device word bits, analog quantities, and timers

Bus Protection

Applications	SEL-487B	SEL-487E	SEL-787Z
Breaker Failure Protection	■	■	■
Bus Differential	■	■	■
Transformer and Machine Current Differential		■	
High-Impedance Bus Differential			■
Low-Impedance Bus Differential	■	■	
Three-Phase Current Inputs	7/10/21‡	6	4
Three-Phase Voltage Inputs	1	2	3

Protection	SEL-487B	SEL-487E	SEL-787Z
27/59 Under-/Overvoltage	■	■	■
46 Current Unbalance	*ƒ*	■	
47 Voltage Unbalance		*ƒ*	
50 (N,G) Overcurrent (Neutral, Ground)		■	■
50P Phase Overcurrent	■	■	■
50Q Negative-Sequence Overcurrent		■	■
51 (N,G) Time Overcurrent (Neutral, Ground)		■	■
51P Phase Time Overcurrent	■	■	■
51Q Negative-Sequence Time Overcurrent		■	■
87 Current Differential	■	■	
87Z High-Impedance Differential			■
Single-Pole Trip/Close	■		
Three-Phase Differential Bus Zones	2/3/6‡	1 or 2+	1
Check Zones	3		

Instrumentation and Control	SEL-487B	SEL-487E	SEL-787Z
79 Automatic Reclosing	*ƒ*	+	
Dynamic Zone Selection	■	■	
SELOGIC Control Equations	■	■	■
Nonvolatile Latch Control Switches	■	■	■
SELOGIC Remote/Local Control Switches	■	■	■
Display Points	■	■	■
Multiple Settings Groups	■	■	■
Substation Battery Monitor	■	■	
Breaker Wear Monitor		■	
Event Report (Multicycle Data)	■	■	■
Sequential Events Recorder	■	■	■
Instantaneous Meter	■	■	■
Demand Meter		■	
Through-Fault Monitor		■	
Software-Invertible Polarities		■	
IEC 60255-Compliant Thermal Model		■	
IEEE C37.118 Synchrophasors		■	
Synchrophasor Real-Time Control		■	
IEC 61850	+	+	+
IEC 61850-9-2 Sampled Values Technology	+	+	
Built-In Web Server	■	■	■
Simple Network Time Protocol (SNTP)	■	■	■
MIRRORED BITS® Communications	■	■	■
Parallel Redundancy Protocol (PRP)	■	■	■
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)	+	+	+
Time-Domain Link (TiDL) Technology	+	+	

Miscellaneous Features	SEL-487B	SEL-487E	SEL-787Z
Connectorized® (Quick Disconnect) Available	+	+	

■ Standard feature + Model option ‡1/2/3 relay application

ƒ May be created using settings

Breaker Failure and Capacitor Bank Protection

Applications	SEL-352	SEL-451	SEL-487B	SEL-487V
Breaker Failure Protection, Number of Three-Phase Breakers	*1*	*2*	*7*	*1*
Bus Differential			■	
Shunt Capacitor Bank Protection		*ƒ*		■
Underfrequency Load Shedding		*ƒ*		*ƒ*
Undervoltage Load Shedding	*ƒ*	*ƒ*	*ƒ*	*ƒ*

Protection				
25 Synchronism Check	■	■		
27/59 Under-/Overvoltage	■	■	■	■
32/37 Power Elements	■	*ƒ*	*ƒ*	■
46 Current Unbalance	■	*ƒ*	*ƒ*	■
47 Voltage Unbalance		*ƒ*	*ƒ*	*ƒ*
49 Equipment Thermal Monitoring	+	*ƒ*		*ƒ*
50FO Flashover Protection	■	■		■
50 (N,G) Overcurrent (Neutral, Ground)	■	■		■
50P Phase Overcurrent	■	■	■	■
50Q Negative-Sequence Time Overcurrent		■		■
51 (N,G) Time Overcurrent (Neutral, Ground)		■		■
51P Phase Time Overcurrent		■	■	■
51Q Negative-Sequence Time Overcurrent		■		■
60 (N,P) Current Unbalance (Neutral, Phase)				■
67 Directional Overcurrent		■		■
81 Under-/Overfrequency		■		■
81R Rate-of-Change of Frequency				■
87 Current Differential			■	
87V Voltage Differential	■	*ƒ*		■
Single-Pole Trip/Close	■		■	

Instrumentation and Control	SEL-352	SEL-451	SEL-487B	SEL-487V
Open-Pole Detection		*ƒ*	*ƒ*	■
Point-on-Wave (POW) Breaker Control	■			
79 Automatic Reclosing	*ƒ*	■	*ƒ*	*ƒ*
SELOGIC Control Equations	■	■	■	■
Voltage Check on Closing		■		
Nonvolatile Latch Control Switches	■	■	■	■
SELOGIC Remote/Local Control Switches	■	■	■	■
Display Points	■	■	■	■
Multiple Settings Groups	■	■	■	■
Substation Battery Monitor	+	■	■	■
Breaker Wear Monitor	+	■		■
Voltage Sag, Swell, and Interruption (VSSI) Recording		■		■
Event Report (Multicycle Data)	■	■	■	■
Sequential Events Recorder	■	■	■	■
Instantaneous Meter	■	■	■	■
Demand Meter		■		■
Harmonic Metering				■
Software-Invertible Polarities		■		
IEC 60255-Compliant Thermal Model		■		
IEEE C37.118 Synchrophasors		■		■
IEC 61850		+	+	+
IEC 61850-9-2 Sampled Values Technology		+	+	
Built-In Web Server		■	■	■
Simple Network Time Protocol (SNTP)		■	■	■
Parallel Redundancy Protocol (PRP)		■	■	■
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)		+	+	
Time-Domain Link (TiDL) Technology		+	+	
SEL-2600 RTD Module Communications	+	■		■

Miscellaneous Features				
Connectorized (Quick Disconnect) Available	+	+	+	+
Synchrophasor Real-Time Control		■		■

■ Standard feature + Model option

ƒ May be created using relay elements and timers

Distribution Protection and Control

selinc.com/solutions/distribution

The complex demands of distributed generation, renewable resources, and an evolving customer base present challenges to distribution systems everywhere. From protection fundamentals to advanced automation, SEL offers the most reliable and efficient solutions for every section of a utility-, industrial-, or commercial-scale distribution system.

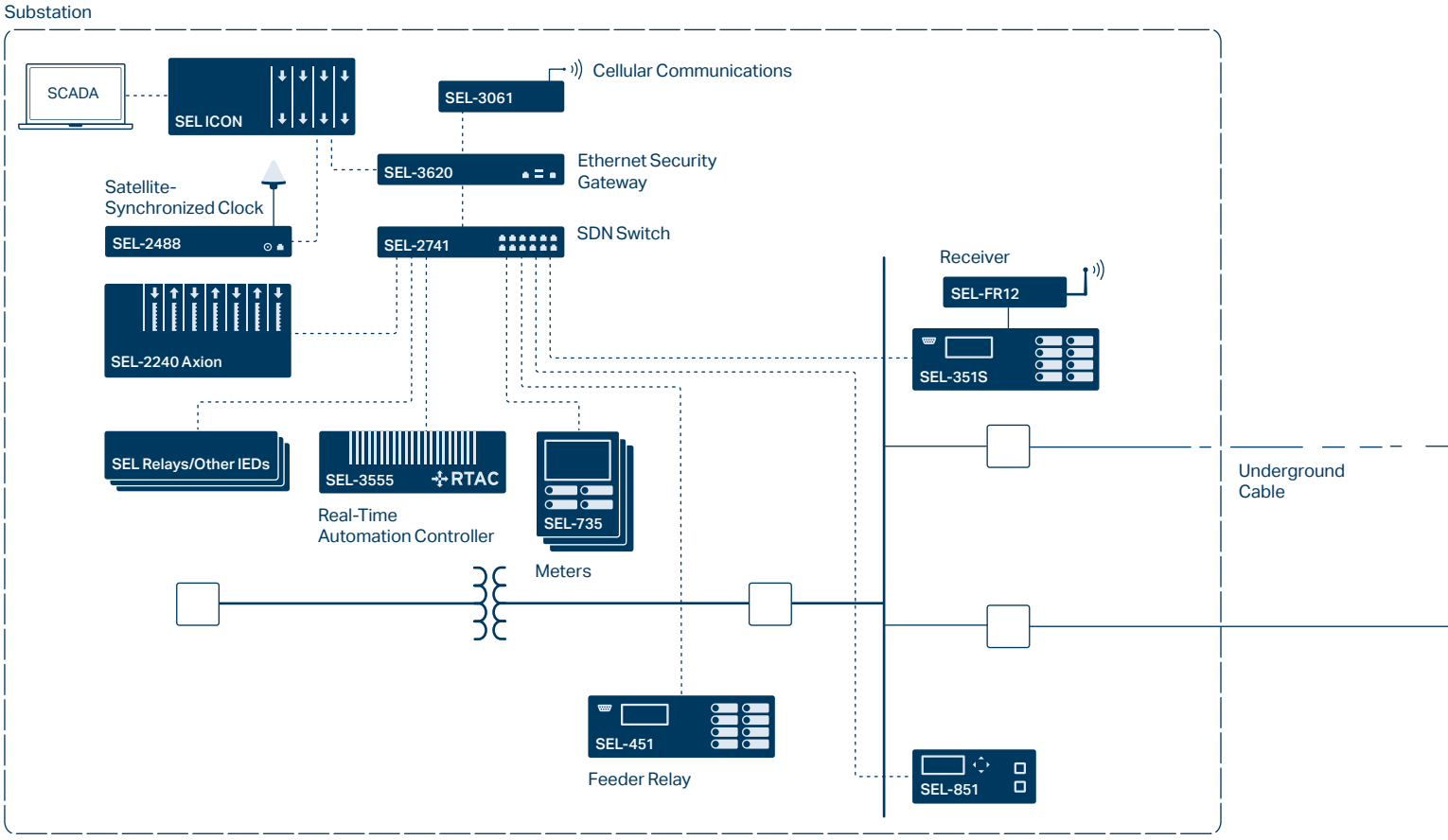
Applications

- Feeder protection
- Transformer protection
- Busbar protection
- Recloser control and protection
- Digital secondary systems
- Arc-flash protection
- Arc Sense™ technology (AST) high-impedance fault detection
- Microgrid control systems (POWERMAX®)
- Distributed generation
- Power quality
- Distribution automation
- Substation automation

Video

SEL-651R—A Better Way to Connect DERs

video.selinc.com/detail/video/6084720804001



Example System Diagram

Combine SEL distribution protection and control products with other SEL automation, monitoring, and wireless communications products for a comprehensive solution.

Webinars

The Next Evolution in FLISR Simplicity: Automatic Configuration With GIS Data

selinc.com/events/on-demand-webinar/138534

Improving Voltage Regulation in Systems With DERs

selinc.com/events/on-demand-webinar/138448

Finding Simplicity in the Complex World of Feeder Protection

selinc.com/events/on-demand-webinar/134425

Technical Papers

Using Existing Distribution Protection and Control Capabilities for Integration of Distributed Energy Resources

selinc.com/api/download/140366

Real-World Troubleshooting With Microprocessor-Based Recloser Controls

selinc.com/api/download/125792

Improving Distribution System Reliability With High-Density Coordination and Automatic System Restoration

selinc.com/api/download/137363

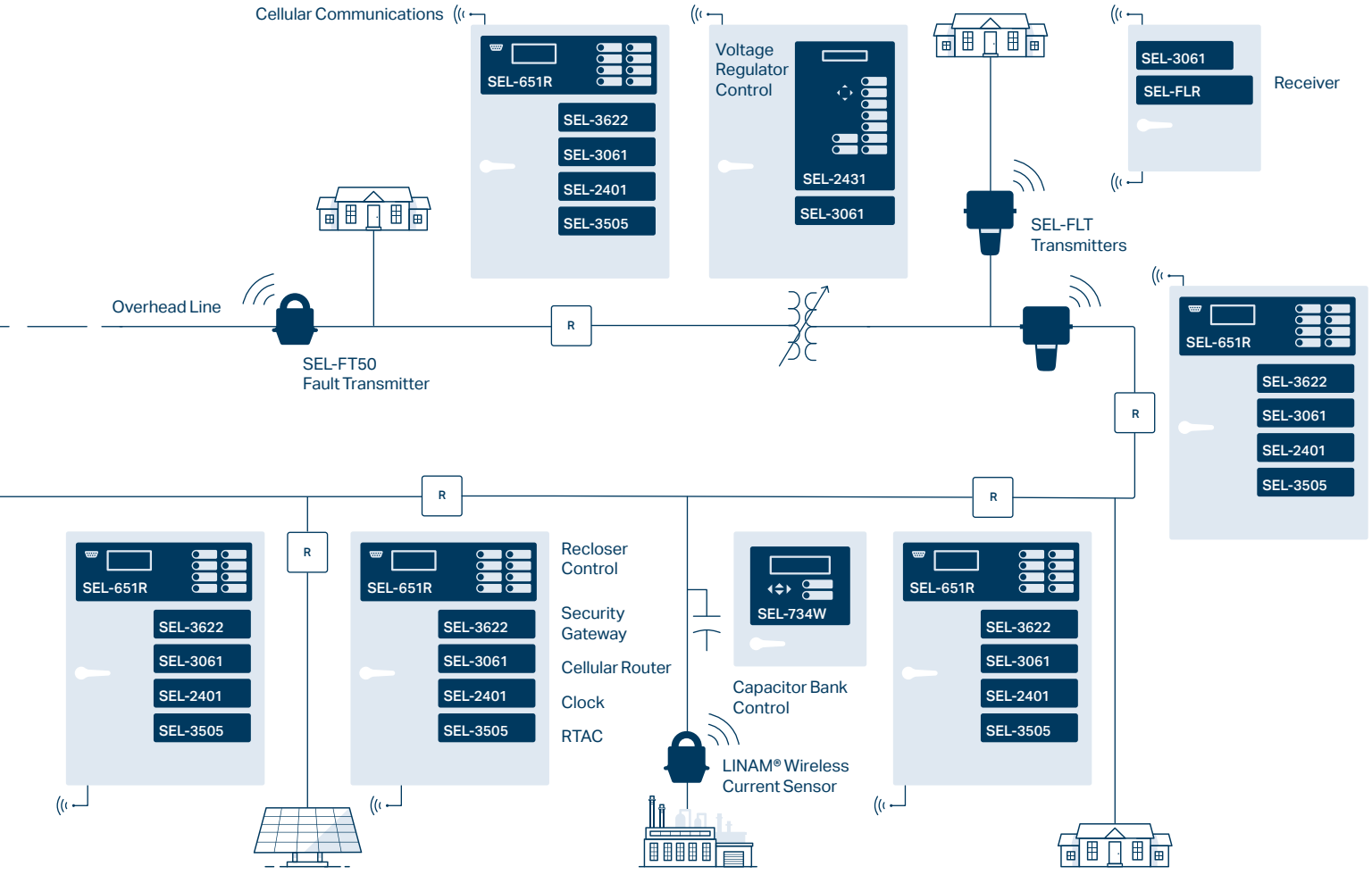
White Papers

Fire Mitigation for Distribution

selinc.com/api/download/126445

Wireless Current Sensing for Improved Distribution Capacitor Bank Control

selinc.com/api/download/130665



SEL-851 Feeder Protection Relay

A compact relay for utility and industrial applications that provides overcurrent, voltage, and arc-flash protection as well as versatile communications.

SEL-751 Feeder Protection Relay

Ideal for industrial and utility feeder protection, offering an intuitive color touchscreen, fast and secure arc-flash detection, flexible I/O, and advanced communications.

SEL-451 Protection, Automation, and Bay Control System

Flexible overcurrent protection with complete substation bay control.

SEL-351 Protection System

Transmission or distribution overcurrent protection, monitoring, and control.

SEL-351A Protection System

An economical solution for distribution feeder protection.

SEL-351S Protection System

Comprehensive feeder and overcurrent protection perfect for industrial and utility feeder applications.

SEL-501 Dual Universal Overcurrent Relay

Two complete and independent groups of protection in one low-cost unit for feeders, buses, transformers, motors, and breakers.

SEL-551/551C Overcurrent/ Reclosing Relay

Distribution protection and control in new and retrofit installations.

SEL Wireless Protection System

SEL-FT50 Fault Transmitter
SEL-RP50 Fault Repeater
SEL-FR12 Fault Receiver

Enhance distribution protection by enabling relays to block reclosing for underground faults, by enabling fast bus tripping, or by coordinating high-density recloser trip blocking.

Applications	SEL-451	SEL-351	SEL-351A	SEL-351S	SEL-851	SEL-751	SEL-751A	SEL-501/501-2	SEL-551/551C
Distribution Feeder Protection	■	■	■	■	■	■	■	■	■
Breaker Failure (BF) Protection	■	■	*ƒ*	■	■	■	■	+	*ƒ*
Generator Intertie Protection	■	■	■	■		+	+		
Synchronism Check (25)	■	■	■	■		+	+		
Underfrequency Load Shedding	*ƒ*	■	■	■	+	■	■		
Undervoltage Load Shedding	*ƒ*	■	■	■	+	+	+		

Protection									
27/59 Under-/Overvoltage	■	■	■	+	+	+	+		
32 Directional Power Elements	■	+		+	+	+	+		
49 IEC Line/Cable Thermal Overload	■					■			
50 (P,N,G,Q) Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■	■	■	■	■	■	■
51 (P,N,G,Q) Time Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■	■	■	■	■	■	■
67 (P,N,Q) Directional Overcurrent (Phase, Neutral, Negative Sequence)	■	■	■	■		+			
78VS Vector Shift						+			
81 Over-/Underfrequency	■	■	■	■	+	■	+		
Separate Neutral Overcurrent	■	■	■	■	■	■	■		■
Load Encroachment Supervision	■	■	■	■		+			
Low-Energy Analog (LEA) Voltage Inputs	+					+			
Directional Sensitive Earth Fault Protection		+	+	+		+			
Pilot Protection Logic	■	■		■					
81R Rate-of-Change of Frequency (df/dt)	■	■	■	■		+	+		
81RF Fast Rate-of-Change of Frequency	*ƒ*					+	+		
Harmonic Blocking	■	■	+	■	■	■			
Arc Sense™ Technology (AST) High-Impedance Fault Detection	+					+			
Arc-Flash Detection					+	+	+		
Phantom Phase Voltage		■	■	■					
Current/Voltage Channels	6/6	4/4	4/4	4/4	4/0 4/3+	4/3 4/5+	4/0 4/5+	6/0	4/0
Complete Two-Breaker Control	■							■	

Instrumentation and Control	SEL-451	SEL-351	SEL-351A	SEL-351S	SEL-851	SEL-751	SEL-751A	SEL-501/501-2	SEL-551/551C
79 Automatic Reclosing	■	■	■	■	■	+	+		■
Fault Locating	■	■	■	■		+			
SELogic® Control Equations With Remote Control Switches	■	■	■	■	■	■	■		■
SELogic Counters	■				■	■	■		
Voltage Check on Closing	■	■	■	■		+	+		
SELogic Nonvolatile Latch	■	■	■	■	■	■	■		+
Nonvolatile Local Control Switches	■	■	+	■	■	■	■		■
Substation Battery Monitor	■	■	■	■		+	+		
Breaker/Recloser Wear Monitor	■	■	■	■		■	■		
Trip Coil Monitor	*ƒ*	*ƒ*	*ƒ*	*ƒ*		*ƒ*	*ƒ*		*ƒ*
Voltage Sag, Swell, and Interruption (VSSI)	■	+		+					
Load/Signal Profile Recorder	■	+		+	■	■	■		
Sequential Events Recorder	■	■	■	■	■	■	■		■
Software-Invertible Polarities	■				■				
IEC 60255-Compliant Thermal Model	■								
DNP3 Level 2 Outstation	■	■	■	■	+	+	+		
Parallel Redundancy Protocol (PRP)	+	■	■	■		+			
IEEE 1588 Precision Time Protocol Version 2 (PTPv2)	+					+			
Time-Domain Link (TiDL®) Technology	+								
IEEE C37.118 Synchrophasors	■	■	■	■		■	■		
Bay Control	■					+			
Ethernet	+	■	■	■	■	+	+		
EtherNet/IP						+			
Built-In Web Server	■				■	■			
IEC 61850	+	+	+	+	+	+	+		
IEC 61850 Edition 2	+				+	+			
IEC 61850-9-2 Sampled Values Technology	+								
Firmware Option With Mirrored Bits® Communications Available	■	■		■	■	■	■		
Simple Network Time Protocol (SNTP)	■	■	■	■	■	+	+		
Harmonic Metering		■	■	■	■				
RMS Metering	■	■	■	■	■	■	■		

■ Standard feature + Model option *ƒ* May be created using settings

SEL-651R Advanced Recloser Control

The SEL-651R provides Automatic Network Reconfiguration and three- and single-phase tripping. It can be used at distributed energy resource (DER) interconnections, for detecting down conductors, and in other distribution automation applications. It is compatible with popular reclosers.

SEL-651RA Recloser Control

The SEL-651RA is a powerful, cost-effective, and flexible recloser control for 14-pin reclosers used in three-phase tripping applications. It can be used at DER interconnections, for detecting down conductors, and in other distribution automation applications. It is compatible with popular reclosers.

SEL-351RS Kestrel® Single-Phase Recloser Control

The SEL-351RS provides integrated logic and communications and comprehensive protection for single-phase applications.

SEL-734B Advanced Monitoring and Control System

The SEL-734B includes low-energy analog inputs and provides advanced monitoring and control capabilities for applications such as capacitor bank control and feeder monitoring.

SEL-734W and LINAM® WCS Capacitor Bank Control and Wireless Current Sensor

This solution is a quick and simple way to provide accurate current-based control for capacitor bank installations and improve power quality.

SEL-2431 Voltage Regulator Control

The SEL-2431 optimizes system voltages and facilitates DER integration by using directional voltage profiles and detailed tap change event reports.

Applications	SEL-351RS Kestrel®	SEL-651R	SEL-651RA
Distribution Feeder Protection	■	■	■
Breaker Failure Protection	*ƒ*	*ƒ*	*ƒ*
Generator Intertie Protection		■	■
Recloser Control	■	■	■
Synchronism Check		■	+
Underfrequency Load Shedding	■	■	■
Undervoltage Load Shedding	■	■	■

Protection	SEL-351RS Kestrel®	SEL-651R	SEL-651RA
25 (G,T) Generator/Intertie Synchronism Check		■	■
27/59 Under-/Overvoltage	■	■	■
32 Directional Power Elements	■	■	+
50 (P,N,G,Q) Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■
51 (P,N,G,Q) Time Overcurrent Element (Phase, Neutral, Ground, Negative Sequence)	■	■	■
67 (P,N,Q) Directional Overcurrent (Phase, Neutral, Negative Sequence)		■	■
78VS Vector Shift		■	■
81 Over-/Underfrequency	■	■	■
81R Rate-of-Change of Frequency (df/dt)	■	■	■
81RF Fast Rate-of-Change of Frequency (ROCOF)		■	■
Separate Neutral Overcurrent		■	■
Load-Encroachment Supervision		■	■
Low-Energy Analog (LEA) Voltage Inputs		+	+
Directional Sensitive Earth Fault Protection		■	■
Pilot Protection Logic		*ƒ*	*ƒ*
Harmonic Blocking	■	■	■
Fast Islanding Detection		■	■
Arc Sense Technology (AST) High-Impedance Fault Detection		+	+
Phantom Phase Voltage	■	■	■
Current/Voltage Channels	1/1	4/6	4/1 4/6[+]

Instrumentation and Control	SEL-351RS Kestrel®	SEL-651R	SEL-651RA
79 Automatic Reclosing	■	■	■
Fault Locating	■	■	+
SELOGIC Control Equations With Remote Control Switches	■	■	■
SELOGIC Counters	■	■	■
Voltage Check on Closing	■	■	■
SELOGIC Nonvolatile Latch	■	■	■
Nonvolatile Local Control Switches	■	■	■
Display Points	■	■	■
Breaker/Recloser Wear Monitor	■	■	■
Trip Coil Monitor	*ƒ*	*ƒ*	*ƒ*
Voltage Sag, Swell, and Interruption (VSSI)	■	■	■
Load/Signal Profile Recorder	■	■	■
Sequential Events Recorder	■	■	■
DNP3 Level 2 Outstation	■	■	■
IEEE C37.118 Synchrophasors	■	■	■
IEEE 1547-2018		■	■
Ethernet	■	■	■
IEC 61850	+	+	+
Simple Time Network Protocol (SNTP)	■	■	■
Harmonic Metering	■	■	■
RMS Metering	■	■	■

■ Standard feature + Model option *ƒ* May be created using settings

Fault Indicators, Sensors, and CTs

selinc.com/products/distribution/fault-indicators | selinc.com/products/FIS/accessories

SEL fault indicators and sensors improve reliability by indicating the fault path to speed up the fault location time and reduce outage duration. Suitable for overhead and underground installations, SEL fault indicators and sensors work in a wide range of applications—from overcurrent fault detection to enhancing system protection.

Applications

- Unfused taps
- Long feeders with midline reclosers or sectionalizers
- Overhead-to-underground transitions
- Feeders that experience recurring faults
- Subsurface or pad-mounted transformers
- Switchgear
- Sectionalizing cabinets
- Junction boxes
- Splices

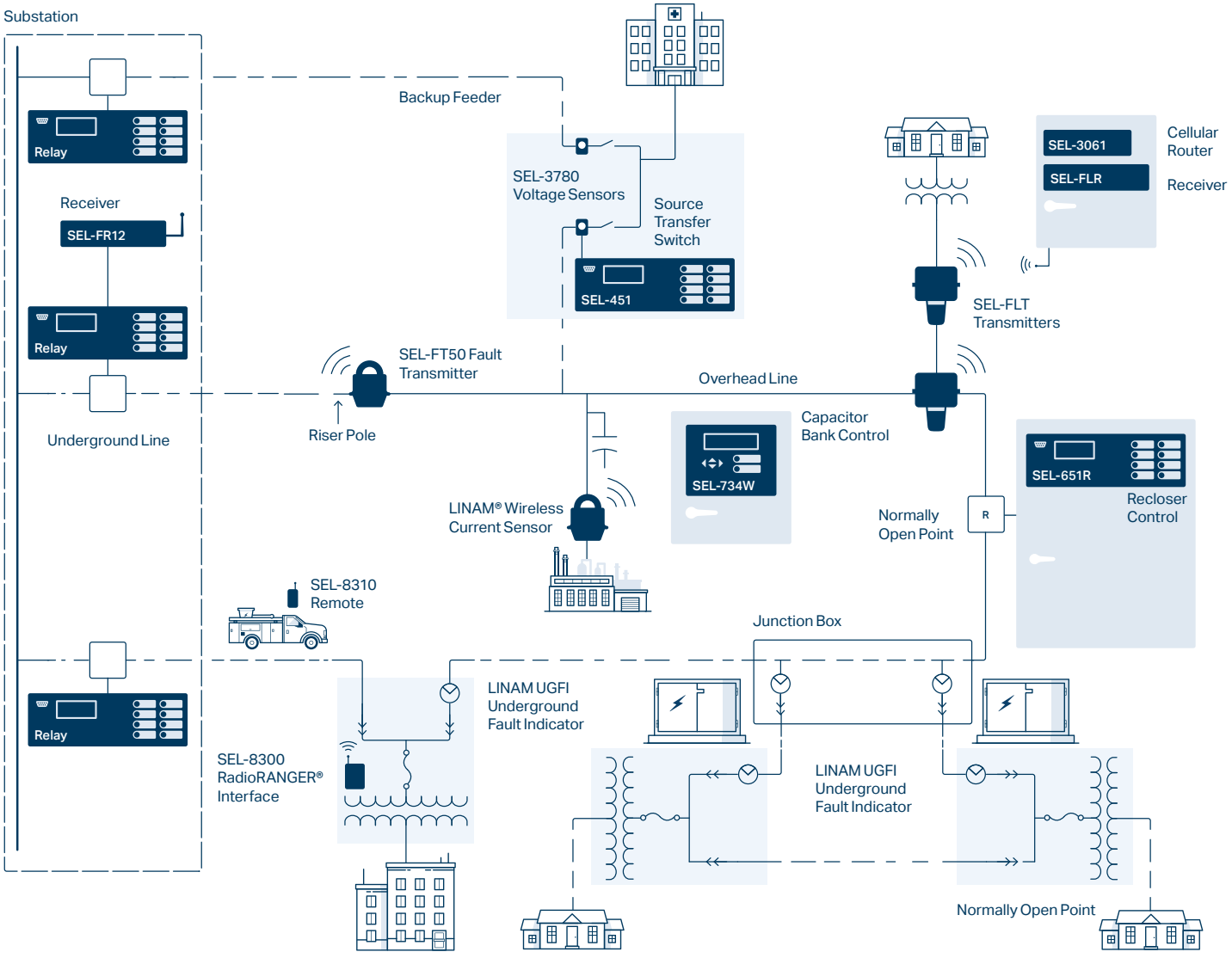
Video

How to Install the AR360 AutoRANGER® Fault Indicator

video.selinc.com/detail/videos/fault-indicators/video/2925549374001

Example System Diagram

Combine SEL fault indicators and sensors with SEL protective relays to enhance protection solutions.



Webinars

A Better Test Point Voltage Sensor for Switchgear

selinc.com/events/on-demand-webinar/135858

Enhance Distribution Protection With the SEL Wireless Protection System

selinc.com/events/webinar/133828

Technical Papers

Emerging Communications and Sensor Technologies That Advance Distribution Automation

selinc.com/api/download/124511

Fast Wind Farm Restoration Using Wireless Fault Sensors to Identify Faulted Segments

selinc.com/api/download/130379

White Papers

Wireless Current Sensing for Improved Distribution Capacitor Bank Control

selinc.com/api/download/130665

Fire Mitigation for Distribution

selinc.com/api/download/126445

SEL-FLT and SEL-FLR Fault and Load Transmitter and Receiver System

Improve overall distribution system reliability with the SEL-FLT and SEL-FLR system, which accurately indicates faults and monitors load. Speed up deployment in pole-mount applications with the system's enclosure.

SEL-AR360 and SEL-AR Overhead AutoRANGER Fault Indicators

Locate momentary and permanent faults in overhead applications. The SEL-AR360 and SEL-AR automatically adjust their trip thresholds to coordinate with the load current in distribution systems.

SEL-ER Overhead Electrostatic Reset Fault Indicator

Provide maintenance-free fault indication with a battery-free design and automatic voltage reset.

SEL Wireless Protection System

Enhance distribution protection by enabling relays to block reclosing for underground faults, by enabling fast bus tripping, or by coordinating high-density recloser trip blocking.

SEL-734W and LINAM® WCS Capacitor Bank Control and Wireless Current Sensor

This solution is a quick and simple way to provide accurate current-based control for capacitor bank installations and improve power quality.

LINAM UGFI Underground Fault Indicator NEW

Reduce outage durations and improve reliability with the LINAM UGFI, featuring line-powered functionality, adjacent phase immunity, and performance that exceeds IEEE 495 standards.

RadioRANGER® Underground Wireless Fault Indication System

Reduce the need to access vaults or open pad-mounted enclosures to retrieve the fault indicator status. Decrease fault-locating time and improve safety.

SEL-TPR Underground Test Point Reset Fault Indicator

Easily install the SEL-TPR on most brands of 200 A or 600 A elbows with capacitive test points. It is ideal for pad-mounted transformer and switchgear applications.

SEL-3780 Test Point Voltage Sensor

Detect system voltage loss on distribution elbows with capacitive test points. The SEL-3780 is part of an economical solution for source transfer schemes.

SEL-PILC Underground Paper-Insulated Lead-Covered Cable Fault Indicator

Apply the SEL-PILC on paper-insulated lead-covered cables. It features a rugged design and can be submerged in up to 15 feet of water.

SEL-MR Manual Reset Fault Indicator

Troubleshoot overhead and underground applications up to 38 kV with this portable, fault-powered manual reset fault indicator.

SEL-VIN Voltage Indicator

Apply the line-powered SEL-VIN to indicate the presence of voltage at or above 2 kV (phase to ground) using a flashing neon lamp. Easily install SEL-VINs on the test point of a 200 A elbow, 600 A T-body, or 600 A basic insulating plug.

SEL-CT Split-Core Current Transformers

Economically add SEL CTs to existing wiring and electrical equipment without interrupting service.

SEL-SCT Submersible Separable-Core Current Transformer

Easily add the SEL-SCT in subsurface vaults where flooding can occur. The separable-core design allows the SEL-SCT to be opened and installed without interrupting the connection.

Metering and Power Monitoring

selinc.com/solutions/metering-solutions | selinc.com/engineering-services/energy-metering

SEL metering products help operators identify power quality issues and improve energy usage in generation, interchange, transmission, distribution, industrial, and commercial applications.

Applications

- Power quality monitoring and troubleshooting
- Usage reporting and billing management system integration
- Load profiling and monitoring

White Paper

Achieve Accurate Metering in Modern Nonsinusoidal Power System Conditions

selinc.com/api/download/123140

Webinars

Advance Power System Awareness With Continuous Waveform Streaming

selinc.com/events/on-demand-webinar/139186

Never Miss an Event: Introducing the SEL-T35 Time-Domain Power Monitor

selinc.com/events/on-demand-webinar/139220

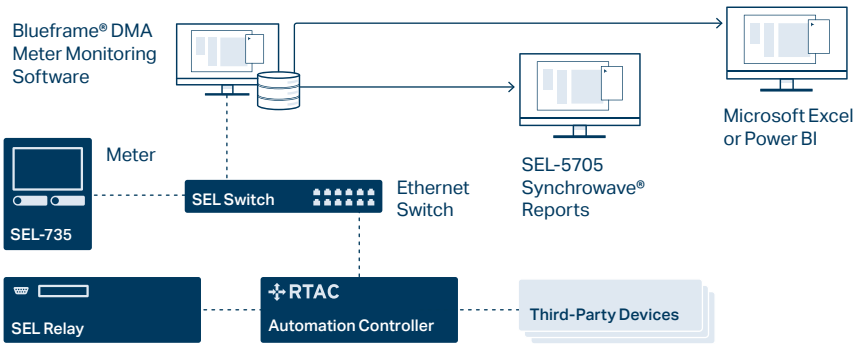
Solutions for Optimizing Energy Metering and Demand Management

selinc.com/events/on-demand-webinar/134511

Customer Story

SEL Meter Helps Data Center Supply High-Quality, Uninterrupted Power

selinc.com/solutions/success-stories/Vantage-Data



Example System Diagram
Combine the SEL-735 with other SEL devices and software for a comprehensive metering data management solution.

SEL-735 Power Quality and Revenue Meter

SEL meters offer bidirectional, full four-quadrant, and high-accuracy energy metering as well as precise and reliable power quality measurements. Multiple mounting and enclosure options and accessories are available; visit selinc.com/products/735.

SEL-5705 Synchrowave® Reports Software

The SEL-735 metering data collected and stored by ACSELERATOR TEAM® SEL-5045 Software allows you to quickly analyze data, identify usage trends, and diagnose system problems.

SEL Data Management and Automation (DMA)—Meter Monitoring

Streamline voltage sag, swell, and interruption (VSSI) and load data profile (LDP) data collection and centralize data storage with the DMA Meter Monitoring application. NEW

SEL-735 Power Quality Options

General	Basic	Intermediate	Advanced
Display	Customizable three-line or single-line display	Customizable three-line or single-line display	One and three-line monochromatic display, or optional customizable 5-inch color touchscreen display
Front Port	ANSI Type II optical port or EIA-232 port	ANSI Type II optical port or EIA-232 port	ANSI Type II optical port or EIA-232 port; Type-C USB*
Memory	128 MB	256 MB	1 GB
Maximum Harmonic Order	15th	63rd	63rd
Interharmonic Quantities	No	No	Yes
Harmonic Angles	No	No	Yes
Power Harmonics	No	No	Yes
Waveform Capture Event Reports			
Samples Per Cycle	16	16, 128	16, 128, 512
Duration (Cycles)	15	15–600	15–600
Number of Events	256	33–6,200	101–10,000
COMTRADE Reports	Yes	Yes	Yes
Wave View Oscillography	No	No	Yes
Load Profile Recorder			
Recorders × Channels	1 × 16	12 × 16	32 × 16
Acquisition Rates	1–120 min	3–59 s, 1–120 min	3–59 s, 1–120 min
Storage Duration for 10-Minute Interval Data			
16 Channels	10 years	20 years	20 years
192 Channels	N/A	1.5 years	9.5 years
512 Channels	N/A	N/A	3.5 years
Voltage Sag, Swell, and Interruption (VSSI) Recorder			
Typical Number of Summary Events	260	260	600
Number of Detailed Rows	60,000	60,000	130,000
Minimum Disturbance Duration	1/4 cycle	1/4 cycle	1/4 cycle
Sampling Rate	4 samples/cycle–1 sample/day, adaptive	4 samples/cycle–1 sample/day, adaptive	4 samples/cycle–1 sample/day, adaptive
Sequential Events Recorder (SER)			
Number of Events	>80,000	>80,000	>80,000
Number of Channels Monitored	≤72	≤72	≤72
IEC 61000-4-30 Power Quality Compliance			
150/180-Cycle, 10-Minute, 2-Hour Aggregation	N/A	Class A	Class A
Flicker	N/A	Class A (10 min, 2 hr updates)	Class A (1 min, 10 min, 2 hr updates)
Voltage Harmonics	Class A	Class A	Class A
Harmonic Currents	Class A	Class A	Class A

*Optional feature

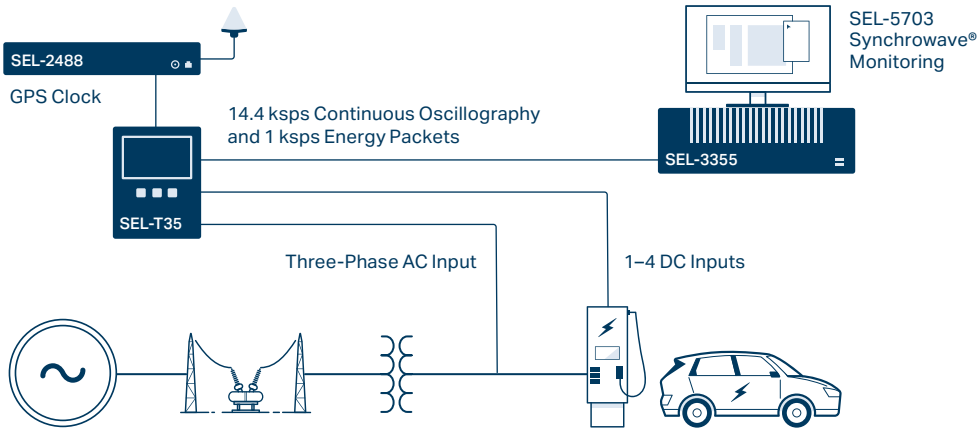
Power Monitoring

SEL power monitoring products allow operators to observe their systems in real time to detect system events and expedite root-cause analysis. They sample voltage and current and send data to SEL Synchrowave software for visualization. The SEL-735 samples at 3 ksps, and the SEL-T35 samples at 14.4 ksps.

Related Material

Capture every disturbance with continuous waveform recording.

selinc.com/api/download/138703



Build a comprehensive power data monitoring solution by combining the SEL-T35 with other SEL devices and software.

SEL-T35 Time-Domain Power Monitor NEW

Stream high-precision ac and dc voltage and current measurements to Synchrowave software for wide-area, real-time data analysis. This data stream also includes energy packets calculated every millisecond, providing energy measurements independent of frequency and phase angles.

Stream voltage and current data at 14.4 kilosamples per second (ksps) and energy calculations at 1 ksps. An integrated ride-through pack ensures that you never miss a disturbance during short-duration outages.

SEL-5703 Synchrowave Monitoring

Calculate and monitor power quality values in real-time using high-rate point-on-wave streaming data. Using the SEL-T35, provides harmonics up to the 63rd, voltage and current rms values, and power calculations, as well as a custom calculation engine and monitoring for Sub-Synchronous Oscillation (SSO) and voltage and current thresholds. Harmonic values calculated by SEL-5703 can be used in IEEE 519 compliance reports.

Automation

selinc.com/products/automation/operations | selinc.com/engineering-services/automation

Increase system reliability and operation efficiency using SEL automation and computing platforms, which offer scalable and modular solutions for data concentration, protocol conversion, and more. SEL automation solutions allow you to implement a broad set of functionalities or choose a subset and add more capabilities over time.

Applications

- Remote terminal unit replacement
- Automated data collection
- Digital fault recording systems
- Network device auditing
- Power management and control systems (POWERMAX®)
- Distributed energy resource integration
- Automatic fault location, isolation, and service restoration
- Bay control
- Phasor measurement unit
- Continuous waveform recording and streaming

Customer Stories

System-Wide Automation Solution Prolongs Life of Existing Relays

selinc.com/solutions/success-stories/system-wide-automation

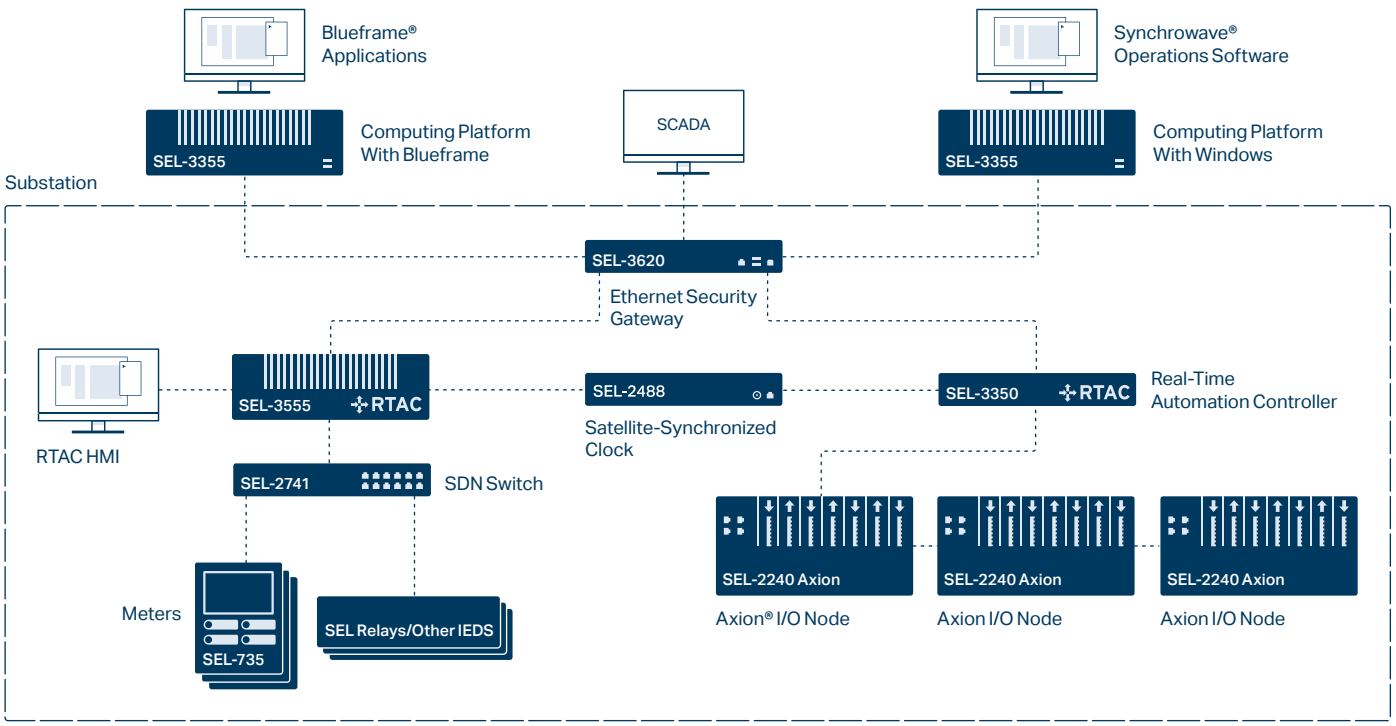
A System of Robust Reliability for the Water and Wastewater Industry

selinc.com/solutions/success-stories/brunswick

Automation News

selinc.com/products/automation/news

Example System Diagram
Combine SEL automation and computing platforms with SEL protective relays and software for a comprehensive solution.



Webinars

Innovating DFR Solutions—Continuous Oscillography, Asset Monitoring, and More
selinc.com/events/webinar/138498

RTAC and Axion® Advancements for RTU and Substation Gateway Applications
selinc.com/events/on-demand-webinar/137925

Managing DERs With RTAC Grid Connect
selinc.com/events/on-demand-webinar/138107

Software-Based Password Rotation With DMA Credential Management
selinc.com/events/on-demand-webinar/137643

Technical Papers

Simplifying Compliance: An Integrated Approach to Meeting NERC PRC-002 and PRC-005 Requirements
selinc.com/api/download/130034

New Advancements in Solar Grid Controllers
selinc.com/api/download/130047

Wind Farm Volt/VAR Control Using a Real-Time Automation Controller
selinc.com/api/download/99167

White Paper

Using Defense in Depth to Safely Present SCADA Data for Read-Only and Corporate Reporting
selinc.com/api/download/120437

Related Materials

SEL Advanced Digital Fault Recorder (DFR) Solutions
selinc.com/api/download/122510

POWERMAX Solutions
selinc.com/api/download/106293

Capture Every Disturbance With Continuous Waveform Recording
selinc.com/api/download/138703

SEL-3350 Computing Platform

The SEL-3350 is a cost-effective model ideal for applications that require midlevel I/O and computation. It can be deployed as an RTAC, an industrial computer running a Microsoft Windows or Linux OS, or a Blueframe application platform.

SEL-3355 Computing Platform

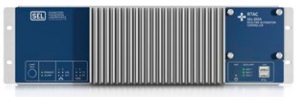
The SEL-3355 is a server-class computing platform built to withstand harsh environments in utility substations and industrial control and automation systems. It can be deployed as an industrial computer running a Microsoft Windows or Linux OS or as a Blueframe application platform.

SEL-3360S/3360E Compact Computing Platform

These models match the performance, ruggedness, and configuration flexibility of the SEL-3355 and are ideal for surface- or panel-mount applications. They can be deployed as industrial computers running a Microsoft Windows or Linux OS or as Blueframe application platforms.

3530-4 Real-Time Automation Controller

The SEL-3530-4 is ideal for concentrating information from relays in one central location and converting between protocols to send information to and from SCADA systems.



SEL-3555 Real-Time Automation Controller

The SEL-3555 provides powerful processing for large-scale automation projects.

SEL-3560E/3560S Real-Time Automation Controller

These RTACs offer powerful processing for large-scale automation projects in a compact form factor.

SEL-2240 Axion®

The Axion is a fully integrated, modular I/O and control solution for utility and industrial applications. With its new 7-inch color touchscreen display option, the Axion can be applied as a bay controller, providing comprehensive monitoring and reliable control of substation bays.

SEL-3505/3505-3 Real-Time Automation Controller

These RTACs offer powerful automation, reporting, and control for low-voltage, limited-space applications.

SEL-3390 PCIe Adapter Cards

SEL-3390E4 Network Adapter Card
SEL-3390S8 Serial Adapter Card
SEL-3390T Time and Ethernet Adapter Card

These expansion cards let you add ports and connectivity to SEL and other industrial automation and computing platforms and may also be used in non-SEL computers.

SEL-2411 Programmable Automation Controller

The SEL-2411 provides flexible I/O for automatic control, SCADA, station integration, remote monitoring, and plant control systems.

SEL-2411P Pump Automation Controller

The SEL-2411P is a standalone, preconfigured, SCADA-ready system for control and monitoring of water and wastewater pump applications.

SEL-2414 Transformer Monitor

The SEL-2414 provides standalone or distributed monitoring and control for new and existing transformers using the optional color touchscreen display.

SEL-2440 DPAC Discrete Programmable Automation Controller

The SEL-2440 offers utility-grade I/O, powerful processing, flexible communications, and microsecond timing.

SEL RTAC HMI

The SEL RTAC HMI offers an easy way to visualize data to monitor and control your system.

SEL Blueframe

SEL Blueframe Application Platform

Scalable and flexible, SEL Blueframe provides a secure operational technology (OT) platform for installing applications and for managing and exchanging data between supported applications.

Distribution Management System (DMS) Application Suite

The DMS suite includes a FLISR (fault location, isolation, and service restoration) application package, which reduces customer outages, improves reliability metrics, and provides rapid fault detection and system restoration.

Data Management and Automation (DMA) Application Suite

DMA applications automatically collect, store, and manage device-specific information to simplify day-to-day management of a system of devices and to support compliance. Applications include:

- Disturbance Monitoring—Collect oscillography and Sequence of Events data.
- Configuration Monitoring—Collect configuration and property data.
- Credential Management—Initiate device credential rotation and central storage.
- Custom Monitoring—Collect specific device files or command results.
- Meter Monitoring—Collect LDP and VSSI reports from SEL devices. NEW

Applications	SEL-3355	SEL-3360E	SEL-3360S	SEL-3350	SEL-3555	SEL-3560E	SEL-3560S	SEL-3530-4	SEL-2240	SEL-3505/3505-3	SEL-3533	SEL-2411	SEL-2411P	SEL-2414	SEL-2440
Collect, Scale Meter Data	+/#	+/#	+/#	+/#	■	■	■	■	■	■	■	■	■	■	
Condition Monitoring				■	■	■	■	■	■	■	■				
IED Report/Event Collection	+	+	+	■	■	■	■	■	■	■	■				
Distributed Fault Recording				+	■	■	■		■						
Collect Targets, Contact Input Status, Fault Location	#	#	#	+	■	■	■	■	■	■	■				
Enable Fiber-Optic Links	+	+		+	+	+		■	■	■	■	■	■	■	■
Control Through IED Outputs				■	■	■	■	■	■	■	■	■	■	■	■
IRIG-B Client Time Synchronization	■	■	■	■	■	■	■	■	■	■	+	■	■	■	■
IRIG-B Server Time Distribution	+	+		■	■	■	■	■	■	■	+				
Transparent "Port Switch"	#	#	#	+	■	■	■	■	■	■	■	■	■	■	■
Windows/Linux Applications in Harsh Environments	+/#	+/#	+/#	+/#											
Running Multiple Applications Simultaneously	■	■	■	■											
Installing Third-Party Software	+	+	+	+											
Security Appliance to Help Satisfy NERC CIP Requirements	#	#	#	+/#	■	■	■	■	■	■	■				
Network Monitoring and Intrusion Detection	#	#	#	#	+										
Virtualization Server	+/#	+/#	+/#												
Engineering Access Point	+/#	+/#	+/#	+/#	■	■	■	■	■	■	■				
IRIG-B Time Distribution and Network Time Protocol (NTP) Conversion	+	+		■	■	■	■	■	■	■	+				
Video Surveillance Control and Archiving/Physical Security Monitoring and Notification	#	#	#	#											
HMI															
Web-Based HMI	#	#	#	+	+	+	+	+	+		+				
Touchscreen Display	+/#	+/#	+/#	+/#					+			+		+	
LCD Display												■	■	■	
Concentrate IED Data For:															
Distributed Control System (DCS)				+	■	■	■	■	■	■	■				
SCADA Master or Remote Terminal Unit (RTU)				+	■	■	■	■	■	■	■				
Remote Third-Party HMI				+	■	■	■	■	■	■	■				
Features															
Protocol Redundancy (DNP3 and IEC 60870-5-101/104 Server)				+	■	■	■	■	■	■	■				
Primary and Standby LAN Support				+	■	■	■	■	■	■	■	■	■	■	■
Optoisolated Inputs/Programmable Outputs				+	■[1]	■[1]	■[1]	■	+	+	■[1]	+	+	+	+
IEC 61131 Logic Engine				+	■	■	■	■	■	■	■				
Cybersecurity Management				+	■	■	■	■	■	■	■				
Real-Time Operating System				+	■	■	■	■	■	■	■	■	■	■	■

■ Standard feature + Model option #Third-party software required [1]Alarm contact only

Hardware	SEL-3355	SEL-3360E	SEL-3360S	SEL-3350	SEL-3555	SEL-3560E	SEL-3560S	SEL-3530-4	SEL-2240	SEL-3505/3505-3	SEL-3533	SEL-2411	SEL-2411P	SEL-2414	SEL-2440
Intel Xeon Quad-Core 64-Bit CPU	■	■	■		■	■	■								
Intel Atom Quad-Core 64-Bit CPU				■											
Power PC Single-Core CPU								■	■	■					
Maximum Error-Correcting Code (ECC) RAM (GB)	64	64	64	8	64	64	64	1	1	0.5					
Supports 3 Independent Displays With Digital Audio	■	■	■	■	■	■	■								
Analog Audio Ports: Line In, Line Out, Microphone	■	■	■												
4 Rear and 2 Front USB 3.1 Ports	■	■	■		■	■	■								
4 Rear USB 2.0 Ports and 2 Front USB 3.1 Ports				■											
Front RJ45 Ethernet Ports				1											
Rear Ethernet Ports	2	2	2	4	2	2	2	2	2	2					
Fiber-Optic Rear Ethernet Ports				+				+	+	+					
Additional Ethernet Ports, Copper RJ45, or Fiber-Optic SFP	8	4			8	4									
EIA-232 Serial Ports	2	2	2		2	2	2								
EIA-232/422/485 Serial Ports				16	6	6		4	4	4/3					
Additional EIA-232/422/485 Serial Ports	24	12		32	18	6									
IRIG-B Input (on COM1)	■	■	■		■	■	■								
IRIG-B Input and Output (BNC and Serial)	+	+		■	+	+		■	■	■					
19" Rack Mount	■			■	■			■	■			+	+	+	+
Panel Mount	+			+	+			+	+			+	+	+	+
Wall Mount		■	■			■	■								
Conduction Cooled Wall Mount		+	+			+	+								
PCI/PCIe Expansion Slots	5	2			3	1									
Solid-State Drives (2.5" SATA, 32 GB–2 TB Drive Options)	4	2	2	2	4	2	2								
High-Voltage 125–250 Vdc, 120–240 Vac Power Supply	■	■	+	■	■	■	+	■	■			■	■	■	■
Medium-Voltage 48–125 Vdc, 120 Vac Power Supply				■				■				■	■	■	■
Low-Voltage 48 Vdc Power Supply	■	■	+		■	■	+								
Low-Voltage 24–48 Vdc Power Supply				■						+					
12–24 Vdc Power Supply										■					
12 Vdc Power Supply			■				■								
External Power Supply			+				+								
Secondary Power Supply	+		+		+		+								
Hot-Swappable Power Supplies	■		■	+	■		■								
Alarm Contact, Alarm LED, Watchdog	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Configurable Universal Control Input				■											
Programmable Auxiliary Bicolor LEDs	3	3	3	4	3	3	3								
Intel Active Management Technology (AMT) v11.8	■	■	■												
Infineon Trusted Platform Module (TPM) v2.0 (Hardware)	■	■	■	■	■	■	■								

■ Standard feature + Model option

Supported Operating Systems and Software	SEL-3355	SEL-3360E	SEL-3360S	SEL-3350	SEL-3555	SEL-3560E	SEL-3560S	SEL-3530-4	SEL-2240	SEL-3505/3505-3	SEL-3533	SEL-2411	SEL-2411P	SEL-2414	SEL-2440
SEL Real-Time Automation Controller (RTAC)				+	■	■	■	■	+	■	■				
SEL Blueframe Operating System	+	+	+	+											
SEL Software	+	+	+	+											
Microsoft Windows IoT Enterprise LTSC	+	+	+	+											
Microsoft Windows Server Standard	+	+	+	+											
Linux (SUSE, Red Hat Enterprise, Ubuntu, etc.) or VMware ESXi	‡	‡	‡	‡											
McAfee Whitelist Antivirus	+	+	+	+											
SEL-5815 PRP Driver for Windows	+	+	+	+											
Network															
Telnet				+	■	■	■	■	■	■	■	■	■	■	■
Secure Shell (SSH)				+	■	■	■	■	■	■	■				
SMTP/Email Notification				+	■	■	■	■	■	■	■				
FTP Server												■	■	■	■
DNP3 LAN/WAN Client/Server				+	■	■	■	■	■	■	■	+	■	+	+
Modbus TCP				+	■	■	■	■	■	■	■	■	■	■	■
IEC 61850 MMS Client/Server				+	+	+	+	+	+	+	+	+		+	+
IEC 61850 GOOSE				+	+	+	+	+	+	+	+	+		+	+
IEC 60870-5-104 Client/Server				+	■	■	■	■	■	■	■				
IEEE C37.118 Client/Server				+	■	■	■	■	■	■	■				
Flex Parse				+	■	■	■	■	■	■	■				
FTP/SFTP Client/Server				+	■	■	■	■	■	■	■				
SNMP Client/Server				+	■	■	■	■	■	■	■				
Lightweight Directory Access Protocol (LDAP)				+	■	■	■	■	■	■	■				
EtherCAT®				+	■	■	■	■	■		■				
EtherNet/IP				+	■	■	■	■	■	■	■				
Precision Time Protocol (PTP)				+	■	■	■	■	■	■	■	■		■	■
Network Time Protocol (NTP)				+	■	■	■	■	■	■	■				
Simple Network Time Protocol (SNTP)				+	■	■	■	■	■	■	■	■	■	■	■
Parallel Redundancy Protocol (PRP)				+	■	■	■	■	■	■	■	■	■	■	■
OPC UA Client/Server				+	+	+	+								
MQTT Client				+	■	■	■	■	■	■	■				
Serial Port Protocols															
SEL Mirrored Bits® Communications				■	■	■	■	■	■	■	■	■	■	■	■
DNP3 Server				+	■	■	■	■	■	■	■	+	■	+	+
Modbus RTU Binary Client/Server				+	■	■	■	■	■	■	■	■	■	■	■
IEC 60870-5-101 Client/Server				+	■	■	■	■	■	■	■				
LG 8979 Client/Server				+	■	■	■	■	■	■	■				
SES-92 Server				+	■	■	■	■	■	■	■				
DNP3 Client/Server				+	■	■	■	■	■	■	■				
CP 2179 Client				+	■	■	■	■	■	■	■				
SEL Fast Messages, Interleaved With ASCII Client/Server				+	■	■	■	■	■	■	■				
SEL Synchrophasors Client				*ƒ*	*ƒ*	*ƒ*	*ƒ*	*ƒ*	*ƒ*	*ƒ*	*ƒ*				
IEC 60870-5 101 Client/Server				+	■	■	■	■	■	■	■				
CDC Type 2 Client/ Server				+	■	■	■	■	■	■	■				
ASCII Flex Parse				+	■	■	■	■	■	■	■				

■ Standard feature + Model option ‡ Supported for customer installation *ƒ* May be created using settings

WAN and LAN Networks

selinc.com/products/communications/wide-area-network | selinc.com/products/communications/local-area-networks

SEL devices combine the connectivity, performance, cybersecurity, and ruggedness required for WAN and LAN applications.

Applications

- Teleprotection systems
- Operational technology (OT) networking
- OT software-defined networking (SDN)
- Analog leased-line service migration
- IT/OT convergence
- IEC 61850 digital secondary systems
- Special protection systems
- Microgrids
- Distributed renewables
- Remedial action schemes
- Facility-related control systems
- NERC CIP
- Land mobile radio (LMR) systems

Webinars

Best Practices for Successful IT/OT Network Convergence
selinc.com/events/webinar/128773

Redefining Ethernet Performance With Software-Defined Networking
selinc.com/events/webinar/130273

Stay TDM or Move to Packet? Do Both With the SEL ICON®
selinc.com/events/on-demand-webinar/138942

Automate SDN Configuration With RTAC and IEC 61850 Files
selinc.com/events/on-demand-webinar/137644

Technical Papers

Using Software-Defined Networking to Build Modern, Secure IEC 61850-Based Substation Automation Systems
selinc.com/api/download/130126

Deterministic Communications for Protection Applications Over Packet-Based Wide-Area Networks
selinc.com/api/download/121072

Taking Full Control of Your Process Bus LAN Using New Ethernet Packet Transport Technologies
selinc.com/api/download/119756

SDN News

selinc.com/products/sdn/news

ICON News

selinc.com/products/icon/news

Solutions Page

OT Software-Defined Networking
selinc.com/solutions/ot-sdn

Customer Stories

Belgium Integrates Offshore Wind Power Into European Grid
selinc.com/featured-stories/elia

A Modern WAN—Simple, Economical, Elegant
selinc.com/solutions/success-stories/a-modern-wan

Defending Critical Substation Communications in Slovenia
selinc.com/highlights/eles

Creating a Better Future: Innovative Substation Modernization in the Philippines
selinc.com/highlights/davao-light

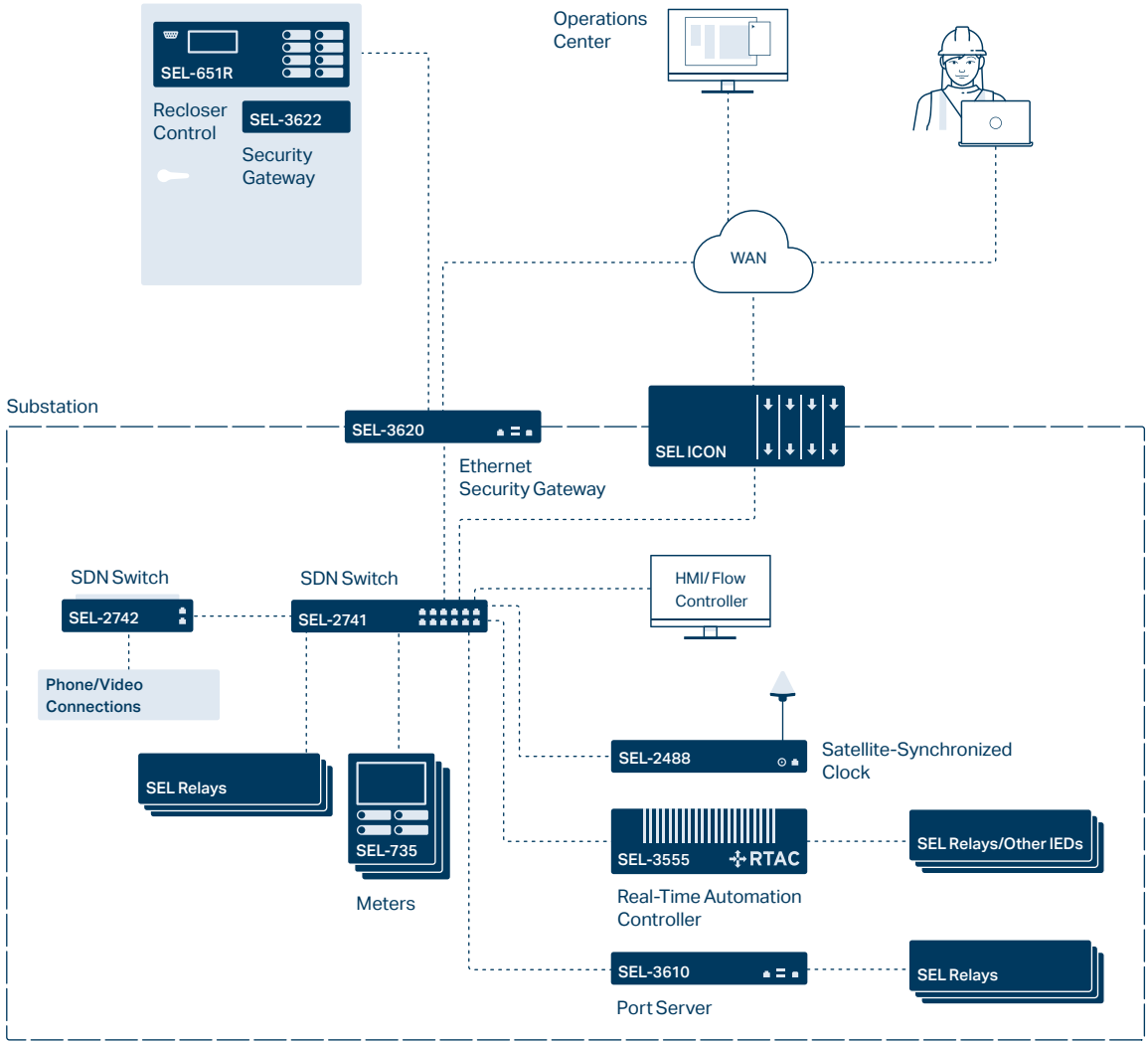
White Papers

Software-Defined Networking Changes the Paradigm for Mission-Critical Operational Technology Networks
selinc.com/api/download/118416

Simplifying NERC CIP Compliance With SEL SDN
selinc.com/api/download/130206

Video

OT Software-Defined Networking: Purpose Engineered for Critical Infrastructure
video.selinc.com/detail/video/1726869976932833649



Example System Diagram
Combine SEL LAN and WAN devices with other SEL protection, automation, and control products for a comprehensive solution.

SEL ICON® Integrated Communications Optical Network

The ICON is a WAN multiplexer optimized for industrial and utility applications. By combining time-division multiplexing (TDM) and Ethernet transport options with a comprehensive range of data interfaces, the ICON makes it easy to migrate legacy network technologies to a packet-based solution.

SEL-2731 Ethernet Switch NEW

The SEL-2731 is an OT SDN and Rapid Spanning Tree Protocol (RSTP) managed Ethernet switch that is optimized for OT environments, supporting critical infrastructure applications.

SEL-2741 Ethernet Switch

The SEL-2741 Ethernet Switch is a 24-port SDN deny-by-default, zero trust, multilayer local-area network Ethernet switch designed to perform reliably in the toughest environmental conditions commonly found in critical infrastructure.

SEL-2740S Software-Defined Network Switch

The SEL-2740S is the industry's first field-hardened SDN-enabled switch and improves cybersecurity and Ethernet performance in mission-critical applications.

SEL-2742 Ethernet Switch

The SEL-2742 is a 12-port, DIN-rail mount SDN switch for industrial environments. It combines with SEL-5056 Software-Defined Network Flow Controller software to simplify network engineering and improve LAN security.

SEL-3620 Ethernet Security Gateway or SEL-3622 Security Gateway

The gateways each function as a router, VPN endpoint, and firewall device. They can provide secure and proxy user access for serial- and Ethernet-based IEDs.

SEL-2730M Managed or SEL-2730U Unmanaged 24-Port Ethernet Switch

These switches let you build reliable, safe Ethernet networks in electrical substations, plants, and other mission-critical sites.

SEL-3610 Port Server

The SEL-3610 increases the number of serial ports available to communications processors and computers and allows serial products to communicate securely through Ethernet networks.

SEL-2725 Five-Port Ethernet Switch

The SEL-2725 allows you to easily connect devices to Ethernet networks.

Applications	SEL ICON	SEL-3620	SEL-3622	SEL-3610	SEL-2725	SEL-2730M	SEL-2731	SEL-2740S	SEL-2741	SEL-2742
SONET WAN	■									
Ethernet LAN	■	■	■	■	■	■	■	■	■	■
E1 and T1 Transport	■									
Precise Time Distribution	■	■	■	■			■	■	■	■
Engineering Access Control		■	■	■			■[1]	■[1]	■[1]	■[1]
Connect Multiple Wired-Ethernet Devices to Network	■				■	■	■	■	■	■
Convert Wired 10/100BASE-T Ethernet to Fiber-Optic 100BASE-FX Ethernet	■	■	■	■	■	■	■	■	■	■
Convert Serial Links to Ethernet Links		■	■	■						
Features										
Cryptography (Encryption and Authentication)		■	■	■						
User-Based Accounts	■	■	■	■		■	■[2]	■[2]	■[2]	■[2]
Centralized Authentication Via Lightweight Directory Access Protocol (LDAP)	■[3]	■	■	■		■	■[2]	■[2]	■[2]	■[2]
Centralized Authentication Via Remote Authentication Dial-In User Service (RADIUS)		■	■	■		■				
Deny-by-Default Firewall		■	■				■[4]	■[4]	■[4]	■[4]
Import/Export Configuration Files	■	■	■	■		■	■[2]	■[2]	■[2]	■[2]
VPN		■	■							
Syslog Logging	■	■	■	■		■	■	■	■	■
Network Management System (NMS) Software	■					■	■	■	■	■
GPS Receiver	■									
Real-Time Latency Monitor	■									
Spanning Tree Protocol (STP)	■	■	■	■		■	■			
Rapid Spanning Tree Protocol (RSTP)	■					■	■			
Multiple Spanning Tree Protocol (MSTP)	■									
VLANs	■	■	■	■		■	■	■	■	■
Ethernet Class of Service (CoS)	■					■	■	■	■	■

Ethernet Ports, Connector	Quantities									
Copper 10BASE, RJ45	0–8[5]	3	3	3	3 or 4	0–20		0–20		2–8
Copper 10/100BASE, RJ45	0–8[5]	3	3	3	3 or 4	0–20	0–24	0–20	0–24	2–8
Fiber-Optic 100BASE, LC	0–8[5]	2	2	2	1 or 2	0–16	0–24	0–20	0–24	0–6
Copper 1000BASE, LC	0–8[5]					4	0–8	0–4	0–24	0–4
Fiber-Optic 1000BASE, LC	4[6]/0–8[7]					0–4	0–8	0–4	0–24	0–4
Small Form-Factor Pluggable (SFP) Cages	4[6]/0–8[7,8]					4	0–24		0–24	

[1]Communication management for engineering access.

[2]SEL-5056 Software-Defined Network Flow Controller software provides centralized authentication, user-based accounts, and import/export configuration files.

[3]SEL-5052 Server Network Management System (NMS) Software provides LDAP centralized authentication for the ICON.

[4]Deny-by-default network access control.

[5]SEL ICON has the option to support up to 16 Ethernet Bridging Access Modules with 4 copper and 4 SFP ports.

[6]SEL-8022-01 Enhanced Protected Line Module supports 2 fiber-optic Gigabit interfaces.

[7]SEL-8036-01 Ethernet Bridging Access Module supports 4 fiber-optic 100BASE-FX/Gigabit interfaces.

[8]SEL ICON uses SFP cages for SONET and GigE fiber-optic interfaces.

Wireless Communications

selinc.com/products/communications/wireless-communications

Wireless communications extend networks in areas where wired communications networks are not available or are cost-prohibitive. SEL wireless devices use radio signals to communicate and send data over the air, eliminating the need for traditional cabling.

Applications

- Cellular router for remote connectivity
- Serial radio for protection schemes

Technical Paper

Expanding Protection and Control Communications Networks With Wireless Radio Links

selinc.com/api/download/121073

Video

Communication Made Easy Over Difficult Terrain

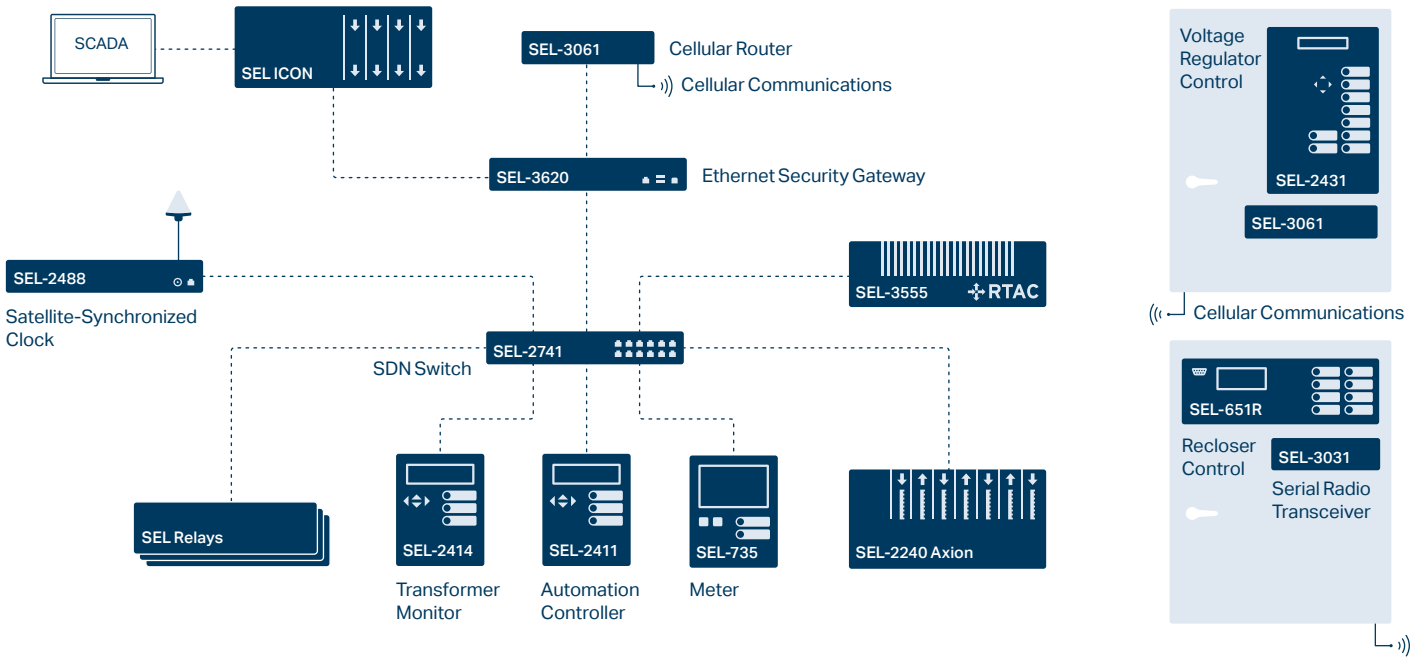
video.selinc.com/detail/video/767833630001

Customer Story

SCADA System Sheds Light on Texas Utility's Power System

selinc.com/solutions/success-stories/scada-in-texas

Example System Diagram
Combine SEL wireless communications devices with SEL protection, automation, and control products for a comprehensive solution.

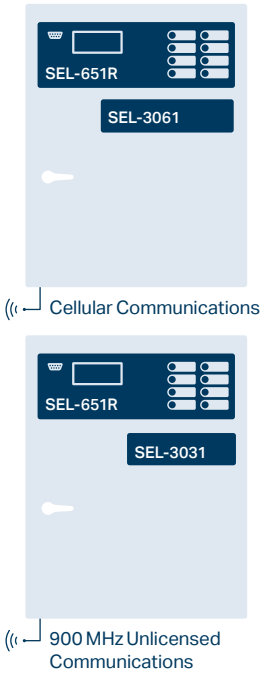


SEL-3031 Serial Radio Transceiver

The SEL-3031 is a 900 MHz ISM serial data radio that supports point-to-point (P2P) and point-to-multipoint (P2MP) operational modes. In P2P mode, the SEL-3031 supports three serial data ports in one radio channel.

SEL-3061 Cellular Router

The SEL-3061 provides secure, remote access for devices using public cellular radio networks. It supports 4G LTE and 3G cellular technologies.



Applications	SEL-3031	SEL-3061
Wireless Communications for SCADA	■	■
High-Speed Teleprotection	■	
Distribution Automation	■	■
Wireless Communications for Synchrophasor Data	■	■
Substation-to-Substation Communications Link		■
Wireless Communications for Distributed Generation	■	■
Permanent Wireless Cable Replacement	■	■
Remote Engineering Access	■	■
Short-Range Engineering Access	■	■
LAN Extension		■
Wireless Backhaul Communications for Fault and Load Transmitters		■

Features		
915 MHz ISM Band (License-Free)	■	
Serial Communication	■	■
Ethernet Communication		■
Low Latency for Teleprotection	■	
Compatible With SEL Mirrored Bits® Communications	■	
Compatible With Modbus	■	■
Compatible With DNP3 and Typical Byte-Oriented Protocols	■	■
Encryption	*ƒ*	■
Point-to-Multipoint Capability	■	
Cellular Capability		■
EIA-232 Port (Quantity)	3	1
Wired EIA-485 Port	+	
High Maximum Throughput (1 Mbps or Greater)		■
Device Status LEDs	■	■
Visible Link Quality Indicator		■

Setup Method		
USB Port	■	
Secure Web Interface Via Ethernet Port		■
Wireless Configuration	■	■
Simple Network Management Protocol (SNMP)		■

■ Standard feature + Model option

ƒ With SEL-3044 Encryption Card option

Precise Time

selinc.com/products/precise-time/satellite-clocks

SEL precise timing solutions keep power system devices time-synchronized within a microsecond, satisfying demanding applications, like synchrophasors, Sampled Values, and traveling-wave fault locating, and ensuring that your event reports have accurate timestamps.

Applications

- Electrical substations
- Generation facilities
- Control centers
- Industrial facilities
- Manufacturing
- Military bases
- Transportation systems
- Land mobile radio (LMR) systems
- Emergency services

Technical Papers

Understanding the Impact of Time Inaccuracy on Synchrophasors, Traveling-Wave Fault Locating, and Line Current Differential Protection

selinc.com/api/download/138657

It's About Time—Considerations and Requirements for DSS and Line Current Differential Applications

selinc.com/api/download/138274

Using Wide-Area Precise Time Distribution to Increase Dependability and Security of Substation Time Synchronization

selinc.com/api/download/136425

SEL-2488 Satellite-Synchronized Network Clock

The SEL-2488 receives multiple input time signals and distributes precise time via 10 MHz frequency, IRIG-B, NTP, and PTP outputs with ±40 ns accuracy.

SEL-2407® Satellite-Synchronized Clock

The SEL-2407 is a half-rack satellite clock with a time display that provides IRIG-B outputs with ±100 ns accuracy.

SEL-2401 Satellite-Synchronized Clock

The SEL-2401 is a compact satellite clock that provides an IRIG-B output with ±100 ns accuracy.

SEL-3400 IRIG-B Distribution Module

The SEL-3400 verifies two IRIG-B inputs and distributes demodulated IRIG-B output for up to 240 devices.

SEL-3405 High-Accuracy IRIG-B Fiber-Optic Transceiver

SEL-3405 transceivers send delay-compensated demodulated IRIG-B signals up to 4 km (2.5 mi).

SEL-9524 GNSS Antenna

The SEL-9524 is a rugged and reliable antenna for GNSS devices in critical infrastructure applications.

SEL-3401 Digital Clock

The SEL-3401 provides a highly visible time display for use anywhere there are time-critical functions set by IRIG-B synchronization signals.

SEL-9929 Satellite-Synchronized Clock Display Kit

The SEL-9929 kit includes a satellite-synchronized clock, a large digital clock display, and all accessories.

SEL ICON® Integrated Communications Optical Network

The ICON provides precise time distribution over WANs, with an accuracy of 1 µs with a variety of input and output protocols.

Applications	SEL-2401	SEL-2407®	SEL-3400	SEL-3401	SEL ICON®	SEL-2488
Time Source for Substation and Industrial Applications	■	■	■		■	■
Digital Secondary Systems (Sampled Values)					■	■
Time Source for Phasor Measurement Unit (IEEE C37.118.1-2011 Synchrophasors)	■	■	■		■	■
Time Source for Recloser	■					
Time Source for Line Current Differential Protection, Traveling-Wave Fault Locating, and Time-Synchronized Event Reporting	■	■	■		■	■
Network Time Synchronization Applications Using the Network Time Protocol (NTP)						■

Time Sources and Time Distribution						
Demodulated IRIG-B Outputs (Quantity)	1	6	12	4*	4	9
Modulated IRIG-B Outputs (Quantity)		1				up to 4
Optional 10 MHz Frequency Outputs (Quantity)						6
GPS Satellite Tracking	■	■			■	■
GLONASS Satellite Tracking (Verification Only)						■
Satellite Signal Verification						■
Demodulated IRIG-B Input			■	■	■	
Synchronized Pulse Output	■	■			■	■
NTP Server						■
IEEE 1588-2008 Precision Time Protocol (PTP) Input (With ITU-T G.8275.1 Telecom Profile)					+	+
IEEE 1588-2008 PTP Output (With IEEE C37.238-2011/2017 Power System and IEC/IEEE 61850-9-3:2016 Power Utility Automation Profiles)					+	+

Features						
Large, 76.2 mm (3.0 in) Tall LED Display for Long-Distance Viewing (61 m [200 ft])				■		
14 mm (0.56 in) Tall Display		■	■			■
Rack-Mount Hardware		■	■	+	■	■
Panel-Mount or Wall-Mount Hardware		■	+	■	■	+
Universal Power Supply		■	■			
Dual, Redundant, Hot-Swappable Power Supplies (High-Voltage or Low-Voltage)					■	■
Power Over Ethernet (PoE) Power Sourcing Equipment (PSE)					■	
Parallel Redundancy Protocol (PRP) and Ethernet Failover Support						■
Secure Web Interface for Configuration						■
Serial Ports for Configuration	■	■				
User-Based Accounts					■	■
TCXO Holdover	■	■			■	■
OCXO, DOCXO, or Rubidium High-Stability Holdover						+
Cable Delay Compensation			■		■	■[1]
IEEE C37.90 and IEC 60255 Surge and Environmental Standards Compliance	■	■	■	■	■	■

Accuracy						
Average Accuracy (ns)	±100	±100				±40
Peak Accuracy (ns)	±500	±500			±1,000	±100

■ Standard feature + Model option/accessory [1]SEL-2488 includes antenna cable delay compensation

Transceivers and Adapters

selinc.com/products/communications/transceivers

Many SEL devices come with standard or optional fiber-optic communications ports. Transceivers convert between copper and fiber optics or between other communications interface standards.

Applications

- Single- or multimode fiber
- Distances ranging from 1 m (3.28 ft) to 110 km (68.35 mi)

Related Material

Fiber-Optic Products and Applications

selinc.com/api/download/2848

Connector and Optics	SEL-2800	SEL-2810	SEL-2812	SEL-9220	SEL-2814	SEL-2815	SEL-2820	SEL-2824	SEL-2829	SEL-2830	SEL-2831	SEL-2894
V-Pin, 650 nm Wavelength	■	■					■					
ST, 850 nm Wavelength			■	■	■	■		■				■
ST, 1,300 nm Wavelength									■	■		
ST, 1,550 nm Wavelength											■	
Fiber Compatibility												
200 µm Core Multimode Fiber (SEL-C805)	■	■	■	■	■	■	■	■				
50 or 62.5 µm Core Multimode Fiber (SEL-C807, SEL-C808)			■	■	■	■		■				■
9 µm Core Single-Mode Fiber (SEL-C809)									■	■	■	
Electrical Features												
EIA-232 Asynchronous Serial Data	■	■	■		■	■			■	■		■
EIA-485 Asynchronous Serial Data				■			■	■				
DTE/DCE Switch					■	■			■	■	■	
IRIG-B Transfer With Data		■	■	■								
Hardware Flow Control Lines With Data					■			■				
Power From Electrical Port Pins	■	■	■	■	■	■			■	■	■	■
External Power Jack or Terminals					■		■	■				
Distances												
Minimum (metric)	1 m	1 m	1 m	1 m	1 m	2 km	1 m	1 m	1 m	16 km	16 km	1 m
Minimum (U.S.)	3.28 ft	3.28 ft	3.28 ft	3.28 ft	3.28 ft	1.24 mi	3.28 ft	3.28 ft	3.28 ft	9.94 mi	9.94 mi	3.28 ft
Maximum (metric)	500 m	500 m	4 km	4 km	4 km	15 km	500 m	4 km	23 km	80 km	110 km	2 km
Maximum (U.S.)	0.3 mi	0.3 mi	2.48 mi	2.48 mi	2.48 mi	9.3 mi	0.3 mi	2.48 mi	14.3 mi	49.7 mi	68.3 mi	1.2 mi

■ Standard feature

SEL-2800/2815 Fiber-Optic Transceivers

Improve safety, signal integrity, and reliability of EIA-232 communications by using multimode SEL-2800 or SEL-2815 transceivers instead of wire.

SEL-2810/2812/2814 Fiber-Optic Transceivers

Use EIA-232 multimode fiber-optic transceivers instead of wire. The SEL-2810 and SEL-2812 support IRIG-B time signals, while the SEL-2814 works with hardware flow control signals.

SEL-2829/2830/2831 Single-Mode Fiber-Optic Transceivers/Modems

Apply the SEL-2829, SEL-2830, or SEL-2831 to use two optical fibers instead of wire to transfer bidirectional serial data.

SEL-2820/2824 Multimode Fiber-Optic EIA-485 Transceivers

Apply an SEL-2820 or SEL-2824 to safely add isolated segments to multidrop and point-to-point EIA-485 networks.

SEL-2890 Ethernet Transceiver

Add Ethernet connectivity to an SEL device using its EIA-232 serial port with the SEL-2890.

SEL-9220 Fiber-Optic Adapter for SEL-300 Series Relays

Convert the EIA-485 port of an SEL-300 series relay to a point-to-point fiber-optic port with the SEL-9220.

SEL-2894 Interface Converter

Apply the SEL-2894 to transfer SEL Mirrored Bits® communications via an IEEE C37.94 fiber-optic link through a communications multiplexer.

SEL-2886 EIA-232 to EIA-485 Interface Converter

Connect EIA-232 devices to an EIA-485 network with SEL-2886 converters.

Cables

selinc.com/products/cables

SEL manufactures high-quality cables for connecting a variety of devices. Each cable is quality-tested to ensure reliability and proper operation. Choose the cable types and lengths to match your applications using the SEL-5801 Cable Selector program.

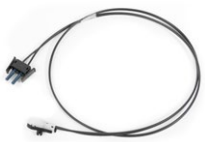
Applications

- GPS and radio antenna connections and IRIG-B time distribution
- Serial communications over long distances without risk of electromagnetic interference
- Adaption and connection to USB ports

Software

SEL-5801 Cable Selector

selinc.com/software/downloads/?filter=SEL-5801



SEL-C804 Multimode Arc-Flash Detection Fiber-Optic Cable

Use SEL-C804 cables with SEL-751 and SEL-851 Feeder Protection Relays and with SEL-710-5 Motor Protection Relays.

SEL-C805 200 µm Multimode Fiber-Optic Cable

Connect V-pin or ST ports with SEL-C805 cable assemblies.

SEL-C807 62.5/200 µm Multimode Fiber-Optic Cable

Use SEL-C807 cable assemblies to connect ST or LC ports.

SEL-C808 62.5/125 µm Multimode Fiber-Optic Cable

Connect ST, SC, or LC ports with SEL-C808 cable assemblies.

SEL-C809 9 µm Single-Mode Fiber-Optic Cables

Use SEL-C809 cable assemblies to connect ST, SC, or LC ports.

Category 5e Ethernet

Apply high-quality, shielded twisted-pair (STP) Category 5e Ethernet cables for copper Ethernet connections.

Coaxial Cables

Use SEL Coaxial Cables for GPS and radio antenna connections and IRIG-B time distribution.

USB Serial Cables

Add a 1.8 m (6 ft) or 4.6 m (15 ft) EIA-232 serial port cable to a PC USB port to communicate with SEL relays and other devices with EIA-232 serial ports.

Electrical Data Cables

Apply SEL Electrical Data Cables to reliably connect SEL products and other devices, including relays, information processors, computers, I/O modules, meters, clocks, and modems.

Connector	SEL-C804	SEL-C805Z	SEL-C805D	SEL-C805G	SEL-C807Z	SEL-C807G	SEL-C808Z	SEL-C808P	SEL-C808G	SEL-C809Z	SEL-C809P	SEL-C809G
V-Pin	■	■	■	■								
ST	■	■	■	■	■	■	■	■	■	■	■	■
LC					■	■	■	■	■	■	■	■
SC							■	■	■	■	■	■

Fiber Diameter (Core/Outer)												
1,000 µm	■											
200 µm		■	■	■								
62.5/200 µm					■	■						
62.5/125 µm							■	■	■			
9/125 µm										■	■	■

Wavelength												
650 nm (Multimode)		■	■	■								
850 nm (Multimode)		■	■	■	■	■	■	■	■			
1,300 nm (Multimode)					■	■	■	■	■			
1,300–1,550 nm (Single-Mode)										■	■	■

Fiber Count												
Simplex (1 Fiber)	■	■			■		■	■		■	■	
Duplex (2 Fibers)	■	■	■	■	■	■	■	■	■	■	■	■
Quad (4 Fibers)			■	■		■			■			

Cable Ratings												
Riser-Rated (OFNR)		■	■		■		■		■	■		■
Plenum-Rated (OFNP)								■			■	
Water-Blocked			■									
Waterproof				■		■			■			■

Jacket Material	SEL-C804	SEL-C805Z	SEL-C805D	SEL-C805G	SEL-C807Z	SEL-C807G	SEL-C808Z	SEL-C808P	SEL-C808G	SEL-C809Z	SEL-C809P	SEL-C809G
Polyvinyl Chloride (PVC)		■	■		■		■	■	■	■	■	■
Polyethylene (PE)	■			■		■						

Termination Kits												
V-Pin Termination Kit	■	■	■	■								
ST Termination Kit	■	■	■	■	■	■						
LC, ST, and SC Termination Kit							■	■	■	■	■	■

Options												
Bulk (No Connectors)	■	■	■	■	■	■	■	■	■	■	■	■
Pulling Loop			■	■		■			■			

Fiber-Optic Compatibility												
SEL-2800/2810/2820		■	■	■								
SEL-2812/2814/2815/ 2824/3405/9220		■	■	■	■	■	■	■	■			
SEL-2829/2830					■	■	■	■	■	■	■	■
SEL-2831										■	■	■
SEL-751/751A/710-5 Arc-Flash Detection	■											
Multimode Fiber-Optic Ethernet					■	■	■	■	■			
Single-Mode Fiber-Optic Ethernet										■	■	■

■ Standard feature

Remote I/O

selinc.com/products/distribution/protection/remote-i-o

Remote I/O modules transfer data from remote locations over fiber and expand the I/O of SEL relays, automation controllers, and other devices without modification to the control panel face.

Applications

- Provide additional I/O for SEL protective relays and information processors
- Save wiring via I/O multiplexing
- Implement teleprotection
- Improve safety with optical fiber

Case Study

Remote I/O Modules Enable DC Substation Transfer Trip for Expanding Denver Light Rail System

selinc.com/api/download/2723

SEL-2505/2506/2507 Remote I/O Module

Connect a remote I/O module to a fiber-optic port or transceiver on a protective relay to add digital I/O. Or, wire the module I/O to relay I/O to add SEL Mirrored Bits® teleprotection.

SEL-2515/2516 Remote I/O Module

Connect these remote I/O modules, which are suitable for use in automation systems, to SEL information processors to easily expand inputs and outputs.

SEL-2595 Teleprotection Terminal

Use the SEL-2595 to securely transfer teleprotection signals through a high-speed IEEE C37.94 optical-fiber interface.

Number of I/O Channels	SEL-2505	SEL-2506	SEL-2507	SEL-2515	SEL-2516	SEL-2595
Digital Inputs (DI) Base	8	8	8	8	8	8
DI Maximum	8	8	8	8	8	8
Digital Outputs (DO) Base	8	8		8	8	8
High-Speed DO Base			8			
DO Maximum	8	8	8	8	8	8
Serial Communications Protocols						
SEL Mirrored Bits Communications	■	■	■			
SEL Fast Messages				■	■	
IEEE C37.94						■
Mounting						
Surface/Wall Mount	■			■		
Rack Mount	■	■	■	■	■	■

■ Standard feature

Annunciation and Notification

selinc.com/products/automation/operations/annunciation

Annunciation and notification devices provide local and remote notification to improve situational awareness, efficiency, and safety. They display alarm conditions, and their communications ports enable integration with relays and control systems.

SEL-2522 Alarm Panel

Apply the SEL-2522 with up to 36 inputs to easily view the status of alarms and operating events.

SEL-2523 Annunciator Panel

Provide local and remote notifications with the SEL-2523, which includes programmable logic and up to four communications ports.

SEL-2533 Annunciator

Use the compact, ten-window SEL-2533 to provide local and remote annunciation.

Applications	SEL-2522	SEL-2523	SEL-2533
Local Visual Indication	■	■	■
Remote Visual Indication		■	■
Local Audible Indication	■	■	■
Remote Audible Indication	■	■	■
Telephone Dial-Out Messages		■	■
Local SELOGIC® Control Equations and Time Tagging		■	■

Mounting and Labeling			
Rack Mount	+	+	
Panel Mount	+	+	■
User-Defined Slide-In Labels	■	■	■

Inputs, Outputs, and HMI	SEL-2522	SEL-2523	SEL-2533
General-Purpose Digital Inputs	36	42	14*
Acknowledge, Reset, Test Digital Inputs	3	6	4*
General-Purpose Digital Outputs	1	11	14*
Alarm Digital Output	1	1	1
General Display LEDs/Windows	36	36	10
Enabled LED	1	1	1
Pushbuttons	3	4	4
Base Serial Ports		1	1
Optional Multimode Fiber-Optic Serial Port		1	1
Optional Additional EIA-232 or EIA-485 Port		1	1
IRIG-B Time Input		1	1
ISA Annunciation Alarm Sequence Choices	2	8	8

Serial Communications Protocols			
SEL MIRRORED BITS® Communications		■	■
SEL Fast Messages		■	■
Send SEL Messenger Points		■	■
Modbus RTU		■	■
DNP3 Level 2 Outstation		+	+

■ Standard feature + Model option

Software

selinc.com/software/downloads | selinc.com/products/compass

SEL software products help automate and control power systems, optimize device configuration, configure secure operational technology (OT) networks, and collect and visualize power system data.

SEL Compass® keeps software applications and relay configuration drivers up to date and includes SEL instruction manuals, application guides, hardware drivers, and more.

Webinars

Streamline Data Collection and Fleet Management With DMA on Blueframe®

selinc.com/events/on-demand-webinar/138573

The Next Evolution in FLISR Simplicity: Automatic Configuration With GIS Data

selinc.com/events/on-demand-webinar/138534

Preventing PT Failures and Locating Generation Loss With Synchrowave® Operations

selinc.com/events/on-demand-webinar/136575

Advance Power System Awareness With Continuous Waveform Streaming

selinc.com/events/on-demand-webinar/139186

Automate SDN Configuration With RTAC and IEC 61850 Files

selinc.com/events/on-demand-webinar/137644

Collect and Visualize Metering Data With Next-Generation Software

selinc.com/events/on-demand-webinar/138791

Case Study

Real-Time Operational Use Cases for Time-Synchronized Measurements With Synchrowave Operations

selinc.com/api/download/134864

Software Product	Configuration	Automation	Visualization and Analysis
ACSELERATOR QuickSet® SEL-5030 Software	■		
SEL Grid Configurator	■		
ACSELERATOR Architect® SEL-5032 Software	■		
ACSELERATOR RTAC® SEL-5033 Software	■		
ACSELERATOR Diagram Builder™ SEL-5035 Software	■		
ACSELERATOR® Bay Screen Builder SEL-5036 Software	■		
SEL-5056 Software-Defined Network Flow Controller	■	■	■
SEL-5051/5052 Client/Server Network Management System (NMS) Software	■		■
SEL Data Management and Automation (DMA) Blueframe Application Suite		■	
SEL Distribution Management System (DMS) Blueframe Application Suite		■	
SEL-5057 SDN Application Suite—Flow Auditor			■
SEL-5231 Configuration API	■		
SEL-5073 SYNCHROWAVE Phasor Data Concentrator (PDC) Software		■	
SEL-5601-2 SYNCHROWAVE Event Software			■
SEL-5702 Synchrowave Operations Software			■
SEL-5703 Synchrowave Monitoring			■
SEL-5705 Synchrowave Reports			■

Example System Diagram
Use SEL software solutions to optimize the configuration and management of SEL devices and networks, provide advanced automation and data collection capabilities, and offer robust tools for data visualization and analysis.

ACSELERATOR QuickSet

Included with supported products

QuickSet is a tool to configure, commission, and manage devices for power system protection, control, metering, and monitoring.

SEL Grid Configurator

Included with supported products

Grid Configurator makes creating, managing, and deploying settings more efficient with its spreadsheet-style editor, protection visualization, comprehensive reporting, custom filters, and multiple-device settings management.

ACSELERATOR Architect

Included with supported products

Architect streamlines the configuration and documentation of IEC 61850 messages, controls, and reports.

ACSELERATOR RTAC

Included with SEL RTAC purchase

ACSELERATOR RTAC is an intuitive, easy-to-use application designed to configure the SEL Real-Time Automation Controller (RTAC) family of products, including the SEL-2240 Axion®.

ACSELERATOR Diagram Builder

Included with RTAC HMI purchase

Diagram Builder enables the creation and management of HMI visualization projects for the SEL RTACs in your system.

Bay Screen Builder

Included with QuickSet and ACSELERATOR RTAC

Bay Screen Builder, which works with QuickSet and ACSELERATOR RTAC, enables the custom creation of bay screens for SEL devices with touchscreen displays.

Software-Defined Network Flow Controller

Included with SEL software-defined networking (SDN) switch purchase

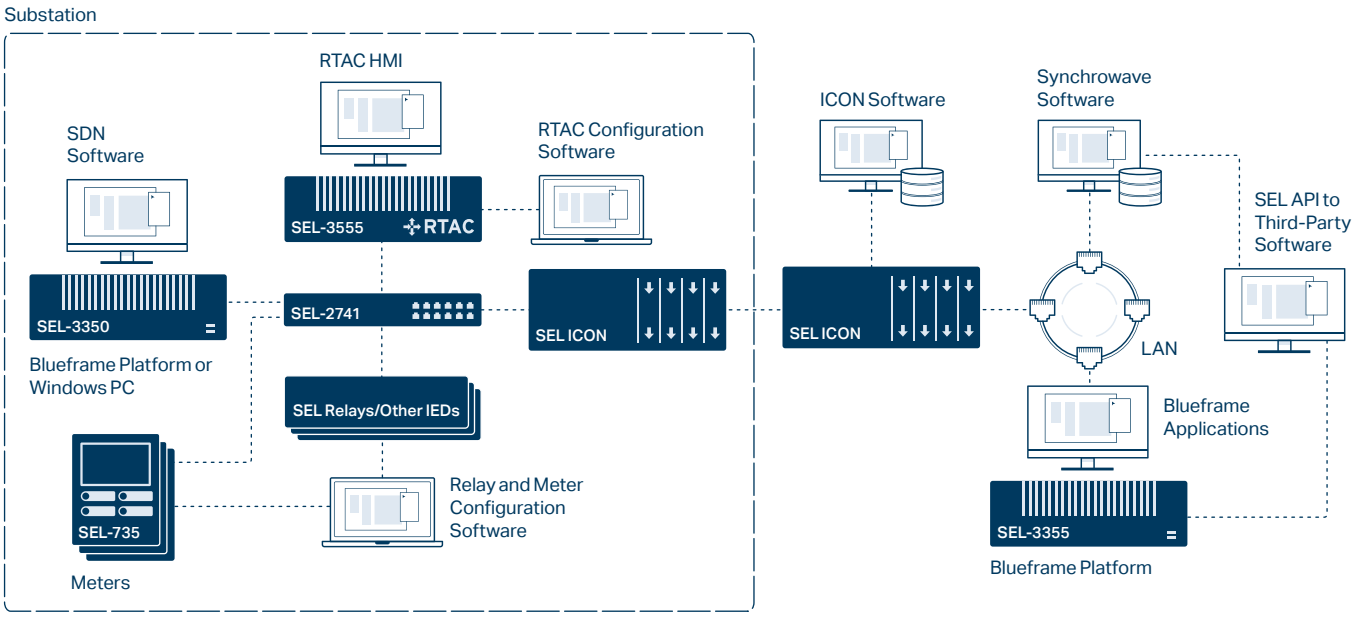
The Flow Controller is the central interface for the commissioning, configuration, and monitoring of all SEL SDN-enabled Ethernet switches.

Client/Server Network Management System (NMS)

The SEL ICON® Client/Server NMS Software helps maintain a secure, reliable, and efficient communications infrastructure.

SDN Application Suite

The SDN Application Suite includes Flow Auditor, which operates with SEL-5056 to provide safe, nondisruptive audits and documentation of conversations between hosts on your critical infrastructure network.



SEL Blueframe Application Platform

Scalable and flexible, SEL Blueframe provides a secure OT platform for installing applications and for managing and exchanging data between supported applications.

Data Management and Automation (DMA) Blueframe Application Suite

SEL DMA applications automatically collect, store, and manage device-specific information to simplify day-to-day management of a system of devices and to support compliance efforts.

Distribution Management System (DMS) Blueframe Application Suite

The DMS suite includes a FLISR (fault location, isolation, and service restoration) application package, which reduces customer outages, improves reliability metrics, and provides rapid fault detection and system restoration.

SEL Configuration API

This API provides an integrated approach to managing SEL device configuration data, offering read/write access to device identification information, connection parameters, passwords, and settings stored in the ACSELERATOR Database.

SYNCHROWAVE PDC

SYNCHROWAVE PDC provides synchrophasor aggregation and time alignment for downstream applications and inter-entity data sharing.

SYNCHROWAVE Event

SYNCHROWAVE Event displays SEL relay event reports and other device data to assist with event analysis.

Synchrowave Reports

Synchrowave Reports simplifies metering and power quality data reporting by analyzing stored metering data and automatically delivering scheduled reports by email.

Synchrowave Operations

Synchrowave Operations increases grid safety and reliability through situational awareness with high-resolution time-series data, real-time analytics, and geographical information system (GIS) location information.

Synchrowave Monitoring

Synchrowave Monitoring brings synchrophasor data and relay event reports together into one place so engineers can analyze both the high-level system impact of an event and the detailed oscillography data.

SEL RTAC HMI

The SEL RTAC HMI offers an easy way to visualize data to monitor and control your system.

Accessories and Tools

SEL-9501 or SEL-9502 Contact Arc Suppressor

Decrease maintenance costs, increase contact reliability, and reduce destructive dc circuit overvoltages with the self-powered SEL-9501/9502 arc suppressors.

SEL-4520 Arc-Flash Test Module

Use the SEL-4520 to conveniently test the operation of arc-flash detection relays installed in metal-clad and metal-enclosed switchgear.

SEL-4388 Mirrored Bits® Tester

Accelerate commissioning and bench testing of SEL Mirrored Bits links and improve training, maintenance, and cable identification with the SEL-4388.

SEL-9510 Control Switch Module

Use the SEL-9510 where independent local control is needed. High-visibility status indication and arc-suppressed contacts are ideal for breaker control.

SEL-2126 Fiber-Optic Transfer Switch

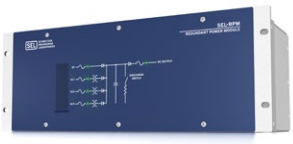
Apply the SEL-2126 to simply reroute any communications protocol carried on the IEEE C37.94 fiber-optic interface standard without moving fiber connectors and without changing communications equipment programming.

SEL-2652 Trip Coil Monitor

Verify circuit breaker or lockout relay trip coil and trip circuit continuity with the SEL-2652.

SEL-2902 RJ45 to DB-9 Adapter Panel NEW

Easily retrofit RJ45 ports to DB-9 connectors using the SEL-2902 adapter panel. The SEL-2902 allows you to retain existing serial cables and transceivers when upgrading from an SEL-3530 Real-Time Automation Controller (RTAC) or SEL-2020/2030/2032 Communications Processor to an SEL-3300 series computing platform.



SEL-RPM Redundant Power Module

Use the SEL-RPM to combine as many as three ac sources and one dc source to provide a single reliable dc output (unregulated 125 Vdc). Large energy storage capacitors provide ride-through capability when all input sources are lost.

SEL-9321 Low-Voltage DC Power Supply or SEL-9322 15 VDC Power Supply

Provide low-voltage dc power from station battery or ac sources for communications devices and accessories with SEL-9321 and SEL-9322 power supplies.

Custom Panels and Enclosures

selinc.com/solutions/custom-panels-enclosures

SEL designs, manufactures, tests, and delivers custom protection, control, and metering panels, control cabinets, retrofit doors, and enclosures. We integrate multiple pieces of equipment (from SEL and other manufacturers) into a single assembly or kit, enabling one-stop shopping for parts and labor with a quick turnaround time. Our experts will work with you to understand your requirements and challenges and provide innovative, economical solutions built to stringent SEL quality standards.

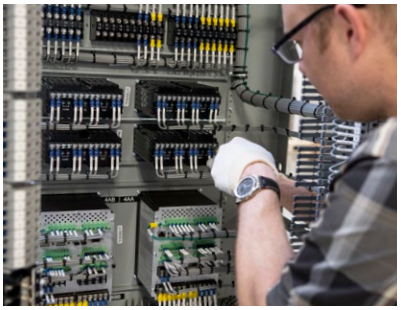
Customer Stories

Partnership and Panels Improve Infrastructure

selinc.com/highlights/rayburn-electric

Distribution Modernization in Kentucky

selinc.com/featured-stories/lge-ku



Complete Panel and Enclosure Solutions

SEL custom panel and enclosure solutions come with the following options and services:

- Consulting, engineering design, and field services.
- Panel and assembly manufacturing and testing in our in-house UL508A-certified panel shop.
- Protection, automation, and control equipment manufacturing.
- Easily extractable assemblies for all SEL-700 and SEL-2400 series products.
- Standard cabinet design for indoor and outdoor applications, including stainless steel, mild steel, aluminum, fiberglass, and polycarbonate enclosures.
- Enclosures, racks, bezels, plates, portables, swing panels, and doors.
- Seismic- and UL-certified cabinets for distribution and automation in adverse environmental conditions.

Complete Design, Manufacturing, Testing, and Commissioning

To exactly meet your needs, we offer complete panel and enclosure solutions, from design through commissioning. We test the final implementation of every product or system before it ships, reducing your overall project costs and engineering time. This testing makes commissioning easier and faster.

Field Services

SEL provides complete installation services during any project phase, from demolition and wiring to testing and commissioning. SEL teams have extensive safety training and provide the same level of quality customers have come to expect from SEL manufacturing and other services.

Available field services include:

- Demolition, retrofit, and upgrade of existing relay panels.
- Installation, integration, and wiring of new relay panels.
- Commissioning and testing support.
- Automation and control system installation.
- SCADA installation.
- Arc-flash solutions.
- GPS and Yagi antenna installation.
- NEMA box and electric panel installation.
- Cable installation for yard equipment through existing conduits.

Direct-Replacement Assemblies

selinc.com/products/7250 | selinc.com/products/7251

Streamline retrofit projects with SEL direct-replacement assemblies for motor, generator, transformer, feeder, and metering applications. These complete, preassembled retrofit kits are designed to closely match the features, form-factor, and terminal blocks of specific legacy digital and electromechanical relays. Direct-replacement assemblies combine field-proven SEL relays with specialized mounting plates, interposing terminal blocks, and other hardware to ensure quick, seamless, and cost-effective upgrades.

Simplify Installation and Configuration

Direct-replacement assemblies deliver an installation experience that is easy, fast, and error-free. The physical installation work for most digital direct-replacement assemblies can typically be completed within an hour. Each assembly fits the existing panel opening and mounting holes. Terminal block arrangements and wiring designations closely match legacy products, and SEL provides wiring labels with all retrofit kits.

Electromechanical direct-replacement assemblies are designed to replace sets of three electromechanical relays aligned horizontally on the same panel with a digital relay and test switch(es). Installation can typically be completed within just a few hours with the removal of the panel dividers between the old relays and the addition of power supply connections.

Minimize Engineering Work

Eliminate time-intensive and costly engineering tasks, such as revising drawings and diagrams. All assembly kits include wiring diagrams, so existing documentation for your system is not required for installation.

Partner With SEL on a Turnkey Solution

We offer complete design, installation, and commissioning services for retrofit projects, saving you time and reducing costs.

Manufacturers we offer direct-replacement assemblies for include:

- GE
- Westinghouse
- Cutler-Hammer
- Eaton
- Square D
- ABB
- Siemens
- Schneider Electric

Engineering Services

selinc.com/engineering-services | esinfo@selinc.com

With a history of successful partnerships spanning a variety of industries throughout the world, SEL Engineering Services helps you see your project through from concept to completion. Our broad menu of services includes electrical, civil, and structural engineering; substation design and drafting; automation and protection services; cybersecurity assessments; quality assurance; field services; and much more.

Our local teams provide consulting services and specialized solutions for projects of any scale, from asset modernization programs to complete substation builds and from microgrids to nationwide power systems. And because we invent and manufacture the hardware; construct world-class panels; manage procurement and construction; install, test, and commission systems; and offer ongoing support long after the project enters service, SEL offers an unmatched level of efficiency, responsiveness, and value.

Featured Services and Solutions

Engineering, Procurement, and Construction Management (EPCM)

SEL Engineering Services performs conceptual design and evaluation, detailed substation design, procurement, and construction management. By combining civil, structural, electrical, and P&C engineering services with comprehensive project management, we ensure a well-defined scope of work, effective budgeting, and a schedule you can rely on.

Power Management and Microgrid Control Solutions

POWERMAX® Power Management and Control Systems intelligently balance generation and load at subcycle speeds to maintain grid stability, prevent widespread outages, and reduce energy costs. These solutions are designed for a variety of applications, including industrial power management systems, remedial action schemes for utilities, and microgrid control systems for commercial, military, and mobile microgrids.

Cybersecurity Services

Our cybersecurity specialists offer an array of products and services to help you develop more secure networks for your operational technology (OT) systems. They provide site vulnerability assessments, comprehensive mitigation strategies, and streamlined solutions for maintaining regulatory compliance and managing system security.

Additional Offerings

- NERC CIP compliance
- Substation engineering services
- SCADA systems and substation HMIs
- Distribution network automation
- Wide-area monitoring systems (WAMS)
- Arc-flash solutions
- Remote terminal unit (RTU) replacements
- Digital fault recording (DFR) systems
- System modeling and studies
- Design and drafting services
- Civil engineering services

Ordering and Customer Support

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Online Configuration and Ordering

Configure products to meet your exact application needs and order them online with an SEL account. Once logged in, select "Configure and Order" on a product webpage to choose from available model options, including items like power supply voltages, inputs and outputs, communications ports and protocols, and conformal coating. Save individual products to your cart, create projects to house specific product orders, and request a quote—all online. For products that do not require configuration or have been identified as common product configurations, select "Popular Models" on a product webpage to quickly and easily find the model you want.

Ordering Support

Our sales representatives and customer service teams are always happy to answer questions and help configure the right SEL solution for your application. Visit selinc.com/support for regional sales contact information.

Popular Models

The Popular Models program makes selecting and ordering SEL products simple, fast, and convenient. SEL popular models are products preconfigured for popular applications and available for many SEL devices. Specific popular models may ship from stock. When available, the popular model configurations are displayed on the related SEL product webpage, where you can also view their technical details and popular applications. You can order these models directly from SEL or through your SEL sales representative.

Local Support. Global Expertise.

Whether it's grid modernization in the Philippines or an ambitious offshore wind integration project in Belgium, our global engineering experts have helped projects in regions like yours succeed. And with local support from technical staff in your region, you can count on us to help your successes continue.

Scan to find a customer support representative in your area.

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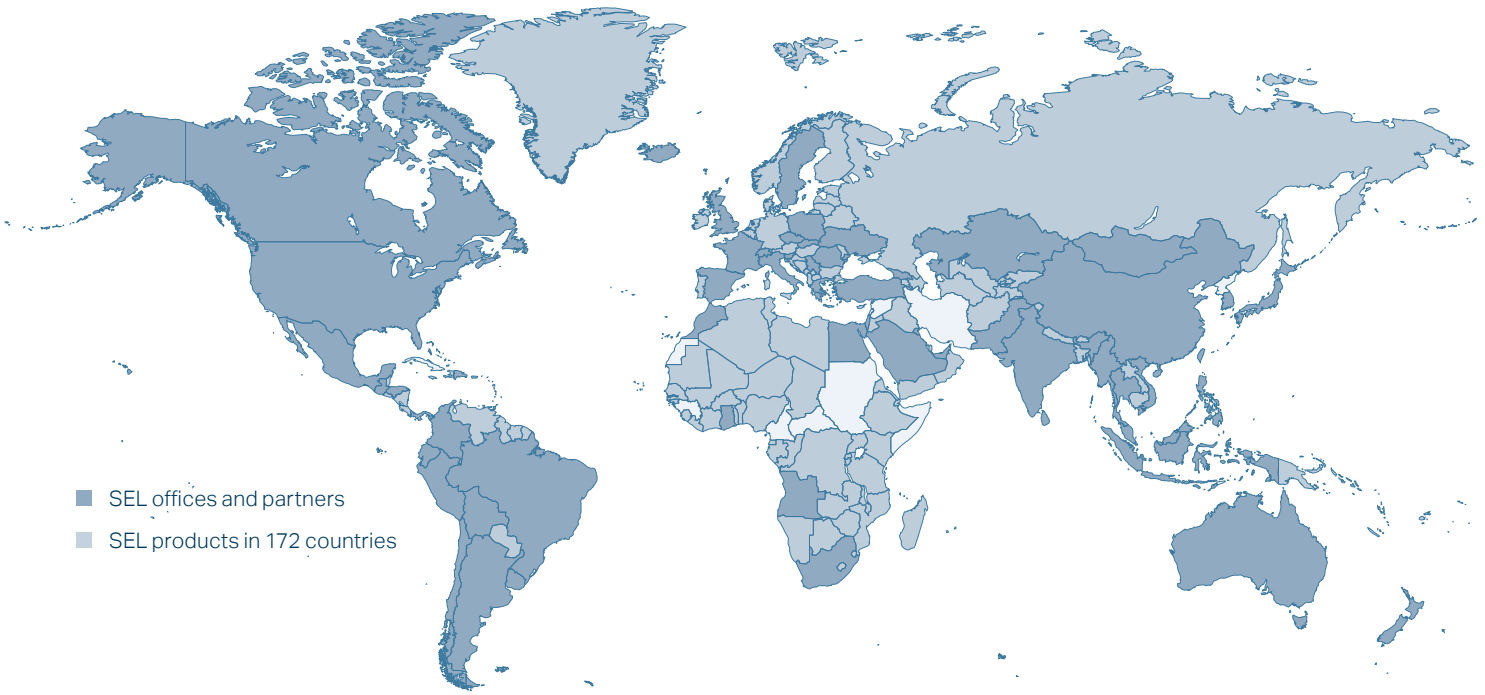

Education and Training

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Online Technical Resources

Get access to secure product information, configure and order products, and register for trainings with an SEL account. Head to selinc.com and click "Login" at the top right corner of your screen. You'll be able to:

- Access secure product information, like application guides and instruction manuals.
- Watch recorded webinars.
- View on-demand virtual presentations.
- Register for seminars, SEL University courses, and other educational offerings.

Schweitzer Drive Podcast

Our "Schweitzer Drive" podcast explores what goes on between the generation of electricity and the light switch. In each episode, SEL President Dave Whitehead talks with the entrepreneurs, innovators, and experts who are inventing the future of electric power. Visit selinc.com/schweitzerdrive to listen.

SEL University

Learn about power system fundamentals, the physics of power system protection, and advanced product applications with courses from SEL University. Gain Professional Development Hours (PDHs) and the confidence to install and commission SEL protection, automation, cybersecurity, and control products. Our training formats include eLearning courses as well as in-person and virtual courses that are taught by the same engineers who design SEL equipment and solutions, support customers, and author industry publications. Our power system experts have trained tens of thousands of industry professionals worldwide to help them meet the technical challenges of integrating digital technologies into their expanding power system infrastructure.

SEL University covers topics such as:

- Introduction to SEL relays.
- Cybersecurity and securing operational technologies (OT) networks.
- SEL Real-Time Automation Controller (RTAC) applications.
- Protecting power systems for engineers.

See available courses and register at selinc.com/selu.

Technical Papers, Webinars, and Videos

SEL power system experts have authored more than 1,000 technical papers, hosted hundreds of webinars, and developed dozens of support videos. They are dedicated to teaching about how our technologies solve complex power system challenges and about how we partner with our customers to solve tough problems. Head to selinc.com to access our library of educational material, including these trending and top five downloaded technical papers:

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Bookstore

Visit the SEL bookstore at selinc.com/bookstore for textbooks and focused technical paper anthologies, like the following:

- Modern Solutions for Protection, Control, and Monitoring of Electric Power Systems
- Synchronous Generator Protection and Control
- Line Current Differential Protection
- Locating Faults and Protecting Lines at the Speed of Light

Modern Solutions for Protection, Control, and Monitoring of Electric Power Systems offers a comprehensive reflection of technologies developed by SEL engineers and spans topics of interest to people working in protection, control, communications, regulation, education, and design.

Online you'll also find these books written by Stanley E. Zocholl, an SEL Distinguished Engineer and IEEE Life Fellow:

- Analyzing and Applying Current Transformers
- AC Motor Protection

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