POWER SOLUTIONS AND SERVICES FROM SEL

SEL®

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SEL teams in 15 countries around the world provide local sales and technical service.

Industries We Serve

At SEL, our more than 25 years of experience with highly reliable, innovative solutions have made us a valued business partner for power management, process control, and factory automation. SEL products are designed to meet the rigorous environmental and operational demands of facilities that must operate flawlessly, 24 hours a day, seven days a week.

Oil, Gas, and Petrochemical

Education and Healthcare

Commercial Buildings

Consumer Products

Life Sciences

Food and Beverage

Electronics

Transportation

Mining and Metals

Renewable Energy

Pulp and Paper

Mission-Critical Facilities

Water and Wastewater

Government

SEL Overview

SEL Headquarters, Engineering, and Manufacturing Facilities, Pullman, Washington, USA
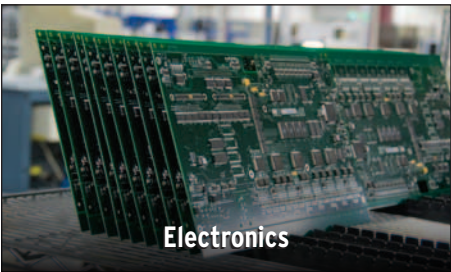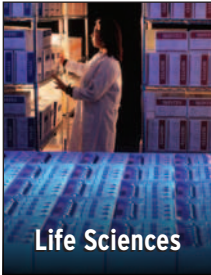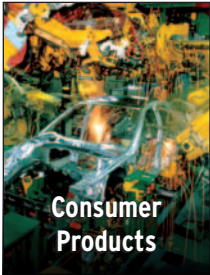
Who We Are

Our mission at SEL is to make electric power safer, more reliable, and more economical. To accomplish this mission, SEL designs, manufactures, and supports a complete line of products and services for the protection, monitoring, control, automation, security, and metering of electric power systems. SEL solutions range from comprehensive generator protection, to distribution automation and control systems.

SEL customers come from a wide variety of industries, including government agencies, airports, universities, water treatment facilities, mining operations, factories, research facilities, data centers, hospitals, pharmaceuticals, refineries, utilities, rural electric cooperatives, and municipalities.

While most SEL product lines are designed and manufactured in Pullman, Washington, SEL also designs and manufactures fault indicators and sensors in Lake Zurich, Illinois, and panels in San Luis Potosí, Mexico. The close relationship between Manufacturing and Research and Development enables SEL to rigorously follow quality standards, beginning first with designs and extending through manufacturing and field support. Our worldwide, ten-year warranty demonstrates our commitment to the quality and value we deliver to our customers. SEL holds ISO 9001:2008 certification and continually exceeds U.S. and international testing standards.

SEL Fault Indicator and Sensor Division, Lake Zurich, Illinois, USA

Where We Are

Teams in 15 countries around the world provide local sales and technical service. With SEL solutions in more than 135 countries, we stay close to our customers. Our commitment to quality extends through a product's installation and life as part of our customers' critical infrastructure. Application and integration engineers, customer service representatives, and sales managers in our national and international technical service centers truly understand the importance of local support. The SEL network of independent sales representatives and distributors provides additional sales support in many regions.

SEL Mexico, San Luis Potosí, Mexico

Where We Came From

Edmund O. Schweitzer, III, Ph.D., founded SEL in 1982 in Pullman, Washington. The company introduced the world's first digital protective relay to the electric power industry in 1984. The first SEL digital relay, the SEL-21, revolutionized the power protection industry by providing fault locating and real fault data at a much lower cost to the customer than traditional electromechanical relays. With the introduction of the load-encroachment element for feeder protection, synchrophasors as a standard feature in protective relays, and MIRRORED BITS® relay-to-relay communications, SEL continues to lead the technology curve.

SEL became an employee-owned company in 1994 and transitioned to 100 percent employee ownership in 2009. With over 2,000 employees around the world, SEL continues to grow in its capacity for innovation and customer support.

The SEL Advantage

What Advantage Can You Expect From SEL Products and Services?

Ranked #1 By Our Customers

North American utilities chose SEL as #1 among protective relay manufacturers for all categories in a recent independent study conducted by Newton-Evans Research Company. They ranked SEL first in technology, price, features, security against hackers, technical support, web information, ease of use, and maintenance cost. International utilities ranked SEL #1 in overall customer experience.

Application, Protection, and Integration Engineering Support

We have experienced field application engineers and integration application engineers available to answer our customers' technical questions. These engineers are located throughout our 43 regional technical service centers in the United States and 30 technical service centers located in an additional 15 countries worldwide. SEL has engineering professionals to provide an array of services, including cost-effective solution designs, application and operation of SEL or other intelligent devices, turnkey solutions, and commissioning.

Exceptional Customer Service

Our customer service representatives understand and anticipate your needs and requirements. Working closely with our customers helps SEL continue to supply the highest quality equipment and services—the cornerstone of SEL's mission and success. Customer service representatives are located at our company headquarters in Pullman, Washington, and in our regional and international technical service centers.

Local Field Offices Worldwide

At SEL, we stay close to our customers through our 73 technical service centers worldwide. We maintain various language skills, in addition to local knowledge and experience with industrial and commercial applications.

Ten-Year, Worldwide Product Warranty

The SEL ten-year, worldwide product warranty is proof of our confidence in the quality products we manufacture, following the strictest industry standards.

Disaster Relief Discount

Safe electrical power can become our lifeline when we are exposed to natural disasters. Rapid response and flexibility are critical during these times of distress. SEL offers a 10 percent discount on all protective relays and associated products destined for natural disaster relief. In addition, SEL will expedite delivery of these relays in order to help restore power at the earliest possible time.

SEL University

SEL University instructors are industry experts with a wealth of technical knowledge and practical experience. Courses are organized into programs with multiple tracks of both power system fundamentals and product application courses. These tracks are designed to meet the needs of engineers, technicians, power system specialists, and managers concerned with protection, monitoring, control, automation, metering, and management of industrial and commercial electric power systems

Certifications

SEL works with customers, sales partners, and accreditation agencies to obtain the certifications necessary to provide relevant products to a variety of industries and markets around the world. Various SEL products, divisions, and procedures have received certification from the following organizations. For more information about SEL's many international certifications, please contact your local sales representative.

- 10 CFR Appendix B Nuclear Quality Program Approval
- ABS Marine Type Approval
- CSA (Canada)
- IEC, including IEC 61850-10 Conformance and IEC 61850-3 Reliability
- IEEE, including IEEE 1613 Reliability
- ISO 9001:2008
- ISO/IEC 17025/A2LA (coming soon)
- KEMA
- LAPEM (Mexico)
- UL
- VPP Star Safety

SEL Products

SEL products are designed and produced for the most challenging environments and exceed industry standards. SEL products operate in a temperature range of −40° to +85°C and, withstand electrostatic shock up to 15 kV and vibration/shock resistance up to 15 g. Many SEL products are available with conformal coating for even greater protection, and all are covered by our no-questions-asked, worldwide, ten-year warranty.

SEL products include:

1. Fast, secure SONET-ring and Ethernet communications for mission-critical infrastructure.

2. Utility-grade computing platforms for trouble-free Linux® and Microsoft® Windows® embedded applications.

3. Easy-to-use software applications provided without license or service fees.

4. Industry standard protocols and media, including Modbus®, DNP, DeviceNet™, Ethernet, Modbus TCP, IEC 61850, FTP, and UCA.

5. Secure communications that ensure the integrity of the power system.

6. Precise time capabilities for synchronization of critical processes and system troubleshooting.

7. Expanded monitoring and control capabilities to substation SCADA systems, plant control systems, or standalone applications.

8. Numerous panel and bezel options for replacing products without panel or switchgear door modification and/or replacement.

Example Industrial Plant One-Line Diagram
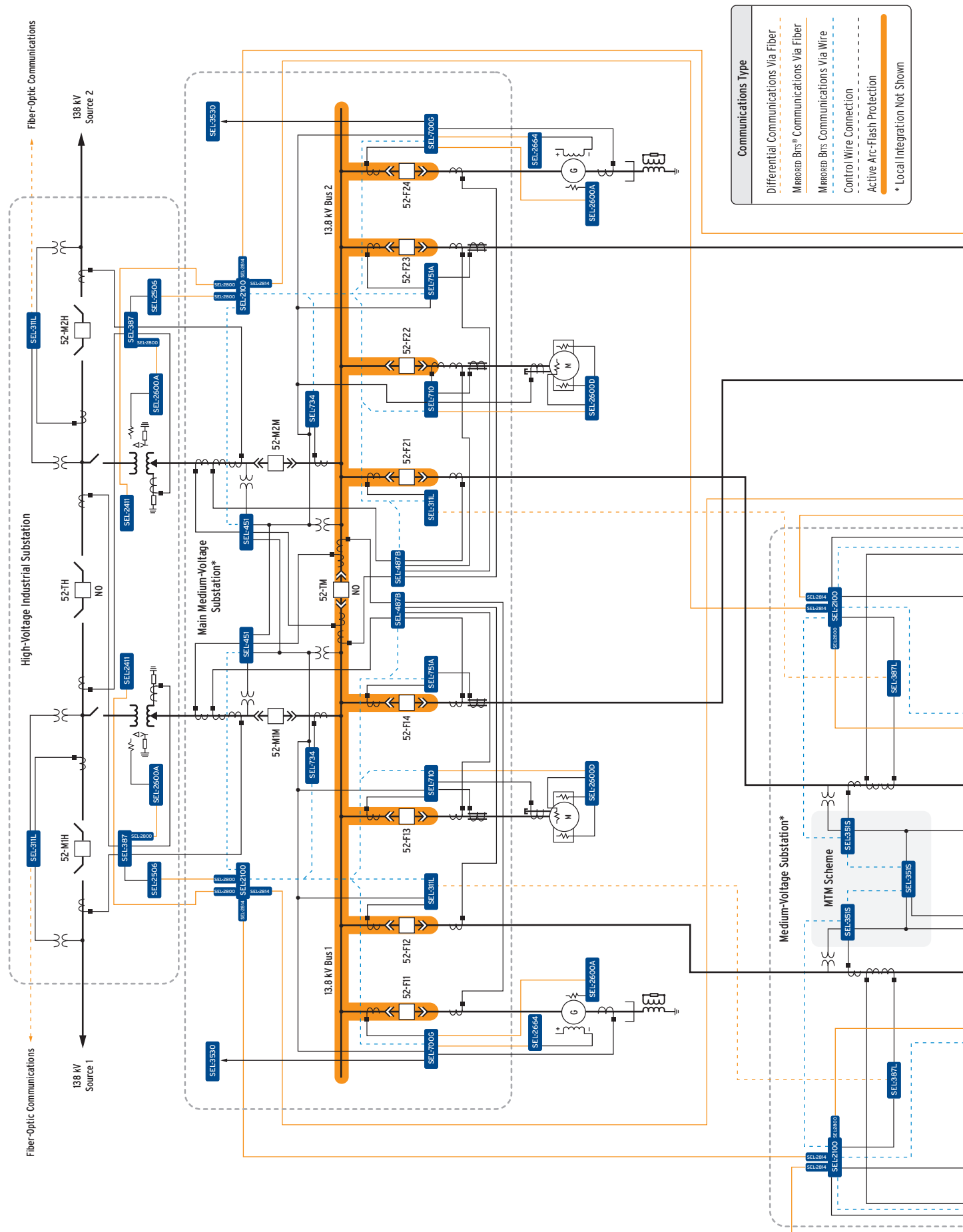
SEL SCHWEITZER ENGINEERING LABORATORIES, INC.

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Generators

- Comprehensive Generator Protection (SEL-300G, SEL-700G)
- RTD Module (SEL-2600)
- Field Ground Module (SEL-2664)

SEL Synchrophasors™
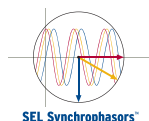
Real-Time Synchrophasor Vector Processor (SEL-3378)

SYNCHROWAVE® PDC With Archiving (SEL-5073)

SYNCHROWAVE Console Software (SEL-5078)

Station PDC (SEL-3373)

Transmission Lines

- Subcycle Distance Relaying (SEL-421)
- Line Differential (fiber, digital channels) (SEL-311L, SEL-411L)
- Midrange Distance (SEL-311)
- Zero-Settings Line Differential (SEL-387L)

Distributed Generation

- Basic DG Relay (SEL-547)
- Intertie Protection (SEL-700GT)
- Wind Generator Protection (SEL-700GW)
- Recloser Controls (SEL-651R, SEL-351, SEL-351R Falcon™)

Substations

POWERCORE™ and POWERCORE-M™ Substation Control Enclosures

- Satellite-Synchronized Clocks (SEL-2407®)
- Digital Clock Display (SEL-3401)
- Protection, Automation, and Bay Control System (SEL-451)
- Low-Impedance Bus Differential (SEL-487B)
- High-Impedance Differential (SEL-587Z)
- Tough Computers (SEL-3354)

- Advanced Metering Systems (SEL-734, SEL-734P, SEL-734T)
- Programmable Automation Controller (SEL-2411)
- DPAC Discrete Programmable Automation Controller (SEL-2440)
- Annunciators (SEL-2522, SEL-2523, and SEL-2533)
- Complete Substation Systems (SEL-7000)
- Communications Processors (SEL-2032)

- Integrated Communications Optical Network (SEL ICON™)
- Station PDC (SEL-3373)
- Modular I/O Network (SEL-2240)
- Real-Time Automation Controllers (SEL-3530/3530-4)
- I/O Devices
- Event Messenger (SEL-3010)

Power Transformers

- Encrypted Serial Radio (SEL-3031)
- Fiber-Optic Transceivers
- Fiber-Optic Transfer Switch (SEL-2126)

Industrial/Commercial

- Motor Protection (SEL-701, SEL-749M)
- Advanced Motor Protection for Direct Retrofit (SEL-710)
- Dual Universal Overcurrent Relay (SEL-501)
- High-Function, Three-Phase Panel Meters (SEL-734, SEL-734P)
- Annunciators (SEL-2522, SEL-2523, and SEL-2533)

- Programmable Automation Controller (SEL-2411)
- DPAC Discrete Programmable Automation Controller (SEL-2440)
- Feeder Protection Relay With Arc-Flash Detection (SEL-751A)
- Fast Bus Transfer (SEL-451)
- Tough Computers (SEL-3354)

Underground Vaults

- Underground AutoRANGER®
- RadioRANGER® Wireless Fault Indication System
- Paper-Insulated Lead Cable Fault Indicator
- Wireless Encrypting Transceiver (SEL-3022)
- Network Protector Relay (SEL-632)

Voltage Regulators

- Voltage Regulator Control (SEL-2431)
- Wireless Encrypting Transceiver (SEL-3022)
- Satellite-Synchronized Clock (SEL-2401)

SEL Product Application Guide

Central Offices
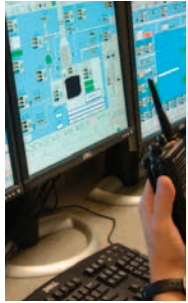
- Enterprise Metering Software
- SCADA Master
- Updated Settings Management Program
- Graphical Settings Software
- State Measurement Software
- Security Manager's Software

- Enterprise Event Viewing Software
- Synchrophasor Visualization Software
- Settings Software
- Application Design Software
- SEL University

SEL Engineering Services and Power Management Solutions

- Model Power System Testing
- Protection and Automation Services
- Arc-Flash Hazard Services
- POWERMAX® Power Management and Control Systems
- Remedial Action Schemes
- Autosynchronization Systems
- Distribution Automation

Five-Winding Transformer Differential With Voltage Protection (SEL-487E)

Four-Winding Transformer Differential (SEL-387)

Three-Winding Transformer Differential With Voltage Protection (SEL-387E)

Two-Winding Transformer Differential (SEL-587)

Two-Winding Transformer Differential With Voltage Protection (SEL-787)

Transformer Monitor (SEL-2414)

Circuit Breakers

Breaker Failure (SEL-352)

Protection, Automation, and Bay Control System (SEL-451)

Shunt Capacitor Banks

Capacitor Protection and Control System (SEL-487V)

Capacitor Control (SEL-734B)

Tough Ethernet Switches (SEL-2725)

Trip Circuit Monitor (SEL-2652)

MIRRORED BITS® Tester (SEL-4388)

Data Courier® (SEL-4391)

Medium Power Transformers

Current Differential Relay (SEL-587)

Current Differential and Overcurrent Relay (SEL-387A)

Transformer Monitor (SEL-2414)

Two-Winding Transformer Differential With Voltage Protection (SEL-787)

Reclosers

Recloser Controls (SEL-651R, SEL-351, SEL-351RS Kestrel™, SEL-351R Falcon)

Encrypted Serial Radio (SEL-3031)

Wireless Encrypting Transceiver (SEL-3022)

Satellite-Synchronized Clock (SEL-2401)

Distribution Feeders

Distribution Protection (SEL-351)

Protection, Automation, and Bay Control System (SEL-451)

Overcurrent/Reclosing Relay (SEL-551)

Dual Universal Overcurrent Relay (SEL-501)

Feeder Protection Relay With Arc-Flash Detection (SEL-751A)

Wireless Overhead AutoRANGER

Overhead AutoRANGER

Current Reset Fault Indicator

SCHWEITZER ENGINEERING LABORATORIES®

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Maximum Performance. Minimum Space.

A Full Line of Compact Relays for All Your Power System Needs

Complete protection and control for new and retrofit applications, detailed event reporting and flexible communications, and software-assisted commissioning and monitoring for all of your industrial and commercial applications.

SEL-700G Generator Protection Relay

The SEL-700G Generator Protection Relay is the right solution for all generator protection, with advanced features, including:

- Comprehensive protection for large, medium, and small generators with numerous voltage, frequency, distance, power, and out-of-step elements.
- Built-in automatic synchronizer that eliminates the need for expensive external synchronizer equipment.
- Single or dual ports, copper or fiber-optic Ethernet or serial communications, and several protocols for custom configurations.
- One hundred percent stator winding coverage to detect state ground faults on high-impedance grounded generators.
- Optional current differential elements that detect stator faults using a secure, sensitive current differential function.
- Sensitive power elements that protect against reverse power, overload conditions, or low forward power.

SEL-751A Feeder Protection Relay With Arc-Flash Detection Technology

The SEL-751A Feeder Protection Relay and flexible I/O are the right solution for industrial applications, including:

- Mitigation of arc-flash hazards with instantaneous light sensing.
- Analysis of overcurrent protection system performance using the built-in Sequential Events Recorder (SER).
- Customization of front-panel pushbutton operation and LEDs or default breaker trip/close function.
- Personalization of LCD messages with event-driven point displays and site-specific references.
- Integrated control systems with various I/O and communications options.
- Comprehensive reporting to assist with understanding events, scheduling maintenance, detecting undesirable trends, modifying loads, and satisfying information requirements of supervisory systems.
- Inclusion of RTD inputs as part of system integration or to bias protection.

SEL-710 Motor Protection Relay

Apply advanced motor protection for the industry's toughest applications:

- Utilize patented slip-based resistance calculation to provide the longest safe start times available for high-inertia motors.
- Allow the soonest possible safe restart times with patented, accurate temperature tracking.
- Apply with reduced-voltage start (including wye-delta starting) and two-speed motors.
- Avoid misoperation during cyclic overloads (e.g., crushers and chippers).
- Monitor motor to confirm motor sizing, understand events, schedule maintenance, modify loads, and provide data to supervisory systems.
- Install in unfavorable environmental conditions. The relay operates from −40° to +85°C with as much as 95 percent relative humidity (noncondensing).
- Plug in optional RTD card for accurate temperature data to bias the thermal overload model.
- Apply built-in positive temperature coefficient (PTC) thermistor motor winding protection.
- Detect load loss from pump cavitation or coupling failure.

Metering

SEL-734 Advanced Metering System

High-accuracy, bidirectional, four-quadrant metering system with power quality monitoring, time-of-use (TOU) metering, load profile recording, and capacitor bank control.

	SEL-734H/V	SEL-734A/D	SEL-734E	SEL-734P/Q	SEL-734B	SEL-734T
APPLICATIONS						
Revenue Metering	•	•	•			
Basic Power Quality, 32 MB	•	•	•		•	•
Advanced Power Quality, 128 MB	*	*	*	•	*	*
Portable Power Quality				•		
Outdoor Metering		•			•	•
Monitor and Capacitor Bank Control	•	•	•		•	•
Distribution Feeder Monitoring		•			•	•
MOUNTING						
Rack, Panel, and Retrofits	•		•		•	
Outdoor Enclosure		•			*	*
Easily Extractable Meter			•			
Portable Case				•		
Surface Mount Transducer						•
INSTRUMENTATION AND CONTROL						
3 Electromechanical Outputs, 2 Inputs	•	•	•	•	*	*
4 Electromechanical Outputs, 4 Inputs	*	*	*	*	*	*
4 Solid-State Outputs, 4 Inputs	*	*	*	*	*	*
4 Solid-State Outputs, 4 Analog Outputs	*	*	*	*	*	*
4 Analog Outputs, 4 Analog Inputs	*	*	*	*	*	*
COMMUNICATIONS						
ANSI Type 2 Optical Port	1	1	1	1	0	0
EIA-232	2 (3)*	2 (3)*	2 (3)*	1	3	2 (3)*
EIA-485	2*	2*	2*	0	2*	2*
Telephone Modem	1*	1*	1*	0	1*	1*
Ethernet	1*	1*	1*	1	1*	1*
IRIG-B Time Input	1	1	1	1	1	1
SERIAL PROTOCOLS						
SEL Fast Messages	•	•	•	•	•	•
Mirrored Bits® Communications	•	•	•	•	•	•
SEL Distributed Port Switch	•	•	•	•	•	•
MV-90(xi) TIM	•	•	•	•	•	•
Modbus® RTU	•	•	•	•	•	•
DNP3 Level 2 Outstation	*	*	*	*	*	*
ETHERNET PROTOCOLS						
SEL	•	•	•	•	•	•
SEL Fast Messages	•	•	•	•	•	•
MV-90(xi) TIM	•	•	•	•	•	•
Modbus TCP Slave	•	•	•	•	•	•
TCP/IP, Telnet	•	•	•	•	•	•
DNP3 LAN/WAN	*	*	*	*	*	*

• *Standard Feature*   ∗ *Model Option*

Applications

Revenue Metering, SEL-734H/V, A/D, EXM
- Collect and report billing, power quality (PQ), and phasor measurements.
- Replace obsolete transducers, and poll directly from SCADA with DNP3 or Modbus® protocols.
- Support complex tariffs with multiple load profile data recorders.
- Provide flexible time-of-use (TOU) metering with a 20-year calendar.
- Use predictive demand to initiate load control and reduce demand charges.

Power Quality, SEL-734P/Q
- Log and view VSSI events.
- Measure harmonic and interharmonic content through the 50th order.
- Monitor PQ anywhere with the SEL-734 Portable Power Quality Meter.

Monitor and Capacitor Control, SEL-734B
- Actively control capacitor banks by monitoring power factor, kVAR, or bus voltage.
- Use SELOGIC® control equations to control multistage capacitor banks.

Digital Transducer, SEL-734T
- Integrate with Lindsey 0–10 Vac CVMI LEA inputs.
- Communicate data instantaneously to SCADA.
- Install virtually anywhere with economical outdoor enclosures.

Generator and Motor Protection

	SEL-700G	SEL-700GT	SEL-700GW	SEL-300G	SEL-547	SEL-710	SEL-749M
APPLICATIONS							
Generator Protection	•	*		•			
Motor Protection				•	•	•	•
Feeder Protection			•				
Breaker Failure Protection	•	•		f	f	•	f
Equipment Thermal Monitoring	*	*	*	*		*	*
Generator Intertie Protection		•			•		
Synchronism Check	*	•		*	•		
Integrated Synchronizer	*	*					
PROTECTION							
21P Phase Mho or Compensator Distance	*			•			
24 Overexcitation (Volts/Hertz)	•	•		•			
27 Undervoltage	•	•		•	•	*	*
32/37 Directional/Underpower Elements	•	•		•	•	*	*
40 Loss-of-Field	•	*		•			
46 Current Unbalance	•	*		•		•	•
47 Phase Reversal					•	•	•
49 Thermal	•	*				•	•
50N/G Neutral/Ground - O/C	•	•	•	•		•	•
50P Phase - O/C	•	•	•	•		•	•
50Q Negative-Sequence - O/C	•	•	•	•		•	
51N/G Neutral/Ground Time - O/C	•	•	•	•		•	
51P Phase Time - O/C		•	•			•	
51Q Negative-Sequence Time - O/C		•	•			•	
59 Overvoltage	•	•		•	•	*	*
64G 100 Percent Stator Ground	*			•			
64F Field Ground	•	*		•			
67G Directional Ground Overcurrent	•	•					
78 Out-of-Step	•			•			
81 Over-/Underfrequency	•	•		•	•	•	•
87 Current Differential	*			*		*	
87G Restricted Earth Fault	•	*					
Separate Neutral Overcurrent	•	*		•		•	•
Inadvertent Energization	f			f			
Flashover Protection	f			f			
Zone/Level Timers	•	•	•	•	•	•	•
INSTRUMENTATION AND CONTROL							
SELOGIC® Control Equations	•	•	•	•	•	•	•
25 Synchronism Check	*	•		*	•		
Nonvolatile Latch Control Switches	•	•	•	•		•	•
Remote Control Switches	•	•	•	•	•	•	•
Local Control Switches	•	•	•	•		•	
Display Points	•	•	•	•		•	
Multiple Settings Groups	•	•	•	•	•		
Station Battery Monitor				•			
Breaker Wear Monitor	•	•	•	•			
Event Report (Multicycle Data)	•	•	•	•	•	•	•
Sequential Events Recorder	•	•	•	•	•	•	•
Instantaneous Meter	•	•	•	•	•	•	•
Demand Meter	•	•	•	•			
Load Profile Report	•	•	•			•	
RTD (Resistance Temperature Detector) Inputs	*	*	*	*		*	*
Ethernet, Modbus® TCP, IEC 61850	*	*	*			*	
Modbus RTU Slave	•	•	•	*	•	•	•
MIRRORED BITS® Communications	•	•	•			•	
DeviceNet™	*	*	*			*	*
MISCELLANEOUS FEATURES							
Accepts Wye or Open-Delta Voltage Transformers	•	•		•	*	*	*
Connectorized® (Quick Disconnect) Available				•	*		

• *Standard Feature*   * *Model Option* f *This function may be created using relay elements and timers*

SEL-700G

The SEL-700G is the right solution for generator protection, with autosynchronizer, flexible I/O, and advanced communications.

SEL-700GT

The SEL-700GT provides an IEEE-1547 compliant intertie protection solution for distributed generation.

SEL-700GW

Protect wind generation feeders and maximize turbine availability by isolating faults with the SEL-700GW.

SEL-300G

Apply the SEL-300G Generator Relay for comprehensive primary and backup generator protection.

SEL-547

Apply the low-cost, compact SEL-547 Distributed Generator Interconnection Relay with essential protection and control elements for distributed generation.

SEL-710

Apply the SEL-710 Motor Protection Relay to accurately calculate slip, minimize time between starts, and precisely track motor temperature.

SEL-749M

Use the reliable and economical SEL-749M Motor Relay to protect three-phase motors, including two-speed and reduced-voltage start motors.

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Bus Protection

	SEL-387	SEL-487B	SEL-487E	SEL-587Z	SEL-311 or SEL-351S With SEL-2100
APPLICATIONS					
Breaker Failure Protection	ƒ	•	•	ƒ	ƒ
Bus Differential	ƒ	•	•	•	ƒ
Transformer and Machine Current Differential	•		•		
High-Impedance Bus Differential				•	
Low-Impedance Bus Differential	•	•	•		ƒ
Three-Phase Current Inputs	4	6/9/18	5	Common	15
PROTECTION					
27 Undervoltage			•	•	•
46 Current Unbalance		ƒ	•		
47 Voltage Unbalance		•	ƒ		
50N/G Ground - O/C	•		•	•	•
50P Phase - O/C	•	•	•	•	•
50Q Negative-Sequence - O/C	•		•	•	•
51N/G Ground Time - O/C	•		•	•	•
51P Phase Time - O/C	•	•	•	•	•
51Q Negative-Sequence Time - O/C	•		•	•	•
59 Overvoltage			•	•	•
87 Current Differential	•	•	•		
87Z High-Impedance Differential				•	
Single-Pole Trip/Close		•			
Directional Comparison			•		ƒ
INSTRUMENTATION AND CONTROL					
79 Automatic Reclosing		ƒ	ƒ		ƒ
SELOGIC® Control Equations	•	•	•	•	•
Nonvolatile Latch Control Switches	•	•	•		•
Remote Control Switches	•	•	•	•	•
Local Control Switches	•	•	•	•	*
Display Points	•	•	•	•	*
Multiple Settings Groups	•	•	•		•
Substation Battery Monitor	•	•	•		•
Breaker Wear Monitor	•		•		•
Trip Coil Monitor	ƒ	ƒ	ƒ	ƒ	ƒ
Event Report (Multicycle Data)	•	•	•	•	•
Sequential Events Recorder	•	•	•	•	•
Instantaneous Meter	•	•	•	•	•
Demand Meter	•		•	•	•
Through-Fault Monitor	•		•		
MIRRORED BITS® Communications		•	•		•
MISCELLANEOUS FEATURES					
Connectorized® (Quick Disconnect) Available	*				*
IEEE C37.118 Synchrophasors			•		
Synchrophasor Real-Time Control			•		
IEC 61850		•	•		

• *Standard Feature*   * *Model Option*

ƒ *This function may be created using relay elements and timers*

SEL-387

Use the SEL-387 Current Differential and Overcurrent Relay for protection, monitoring, and automation applications for important buses, transformers, generators, and other power apparatus.

SEL-487B

Apply the SEL-487B Bus Differential and Breaker Failure Relay for busbar and breaker failure protection, automation, and control in applications with up to six terminals per relay.

SEL-587Z

Apply the SEL-587Z High-Impedance Differential Relay for single-zone bus protection, reactor protection, or sensitive restricted earth fault protection on grounded, wye-connected power transformer windings.

SEL-311L

Apply the SEL-311L Line Current Differential System for distance protection, reclosing, monitoring, and control.

SEL-351S

Simplify feeder protection and control with the SEL-351S Protection and Breaker Control Relay.

Distribution Line Protection

	SEL-751	SEL-751A	SEL-451	SEL-351	SEL-351A	SEL-351S	SEL-501/501-2	SEL-551/551C	SEL-2431	SEL-351R	SEL-651R
APPLICATIONS											
Distribution Feeder Protection	•	•	•	•	•	•	•	•		•	•
Breaker Failure Protection	•	•	•	f	f	f	*	f		f	f
Automatic Reclosing	•	*	•					•		•	•
Generator Intertie Protection	•	*	•	•	•	•				•	•
Recloser Control										•	•
Synchronism Check	*	*	•	•	•	•				•	•
Underfrequency Load Shedding	•	•	f	•	•	•				•	•
Undervoltage Load Shedding	•	*	f	•	•	•				•	•
32-Step Single-Phase Voltage Regulator									•		
PROTECTION											
27/59 Under-/Overvoltage	•	*	f	•	•	•				•	•
32 Directional Power Elements	•	*	f	*		*					•
49 Thermal Overload			f								
50 Overcurrent Element (50P, N, G, Q)	•	•	•	•	•	•	•	•		•	•
51 Time-Overcurrent Element (51P, N, G, Q)	•	•	•	•	•	•	•	•		•	•
67 Directional Overcurrent (67P, N, Q)	*		•	•	•	•				•	•
81 Over-/Underfrequency	•	•	f	•	•	•				•	•
Separate Neutral Overcurrent	•	•	•	•	•	•		•		•	•
Load-Encroachment Supervision	*		•	•	•	•				•	•
MIRRORED BITS® Communications	•	•	•	*		*				*	•
Sensitive Earth Fault Protection		*		*	*	*				•	•
Directional Sensitive Earth Fault Protection				*	*	*				•	•
Pilot Protection Logic			•	•		•				•	f
Rate of Change of Frequency df/dt	•	*	f								
Arc Sense™ Technology (AST) High-Impedance Fault Detection	*		*								
Arc-Flash Detection	*	*									
Phantom Phase Voltage				*	*	*				•	•
Current/Voltage Channels	4/4	4/4	6/6	4/4	4/4	4/4	6/0	4/0	1/2	4/4	4/6
Complete Two-Breaker Control			•				•				
INSTRUMENTATION AND CONTROL											
79 Automatic Reclosing	•	*	•	•	•	•		•		•	•
Fault Locating	•		•	•	•	•				•	•
SELOGIC® Control Equations	•	•	•	•	•	•	•	•		•	•
SELOGIC Counters	•	•	•						•	*	•
Voltage Check on Closing	*	*	•	•	•	•				•	•
Operator Control Pushbuttons	•	•	•			•			•	•	•
SELOGIC Nonvolatile Latch	•	•	•	•	•	•		*		•	•
Remote Control Switches	•	•	•	•	•	•		•		•	•
Nonvolatile Local Control Switches	•	•	•	•	*	•		•		•	•
Display Points	•	•	•	•	*	•		•		•	•
Multiple Settings Groups	•	•	•	•	•	•				•	•
Substation Battery Monitor	•	*	•	•	•	•					
Breaker/Recloser Wear Monitor	•	•	•	•	•	•				•	•
Trip Coil Monitor	f	f	f	f	f	f		f		f	f
Voltage Sag/Swell/Interrupt Recorder				*		*					•
Load Profile Recorder	•	•	*		*				•	*	
Sequential Events Recorder	•	•	•	•	•	•		•		•	•
Demand Meter	•	*	•	•	•	•	•	•		•	•
DNP3 Level 2 Outstation	*	*	*	•	•	•			•	*	*
Modbus® Slave	•	•		•	•	•	*	*			
Synchrophasors	•	•	•	•	•	•					
Bay Control			•								
Ethernet	*	*	*	•	•	•					
IEC 61850	*	*	*	*	*	*					
Independent Trip/Close Pushbuttons			•	*	*	*					
Harmonic Metering				•	•	•			•		•
RMS Metering	•	•	•								•
MISCELLANEOUS FEATURES											
Accepts Delta Voltage Transformers	•	•		•	•	•			•		
Connectorized® (Quick Disconnect) Available			*					*	•	•	
Configurable Labels	*	*	•			*				*	*
Vac/Vdc Power Supply	•	•	•	•	•	•	•	•			

• *Standard Feature*   ∗ *Model Option*   f *This function may be created using relay elements and timers*

SEL-751A

The SEL-751A Feeder Protection Relay with arc-flash detection is the right solution for industrial feeder protection, with innovative light sensing, flexible I/O, advanced communications, and easy mounting options.

SEL-451

Combine directional overcurrent protection with complete control by using the SEL-451 Protection, Automation, and Bay Control System.

SEL-351

Choose the SEL-351 Directional Overcurrent and Reclosing Relay for transmission or distribution overcurrent protection.

SEL-501

Simplify protection in two-high switchgear with two independent sets of protection elements in the SEL-501 Dual Universal Overcurrent Relay.

SEL-551

Combine overcurrent protection and multiple-shot reclosing in the SEL-551 Overcurrent/ Reclosing Relay.

SEL-2431

Optimize system voltage with the SEL-2431 Voltage Regulator Control, using directional voltage profiles and detailed tap-change event reports.

SEL-351R

Use the SEL-351R Recloser Control for easy recloser control upgrades with advanced directional overcurrent and frequency elements as well as communications-assisted protection schemes.

SEL-651R

Apply the SEL-651R Advanced Recloser Control with Automatic Network Reconfiguration, single-phase tripping, and harmonics metering.

Breaker Failure and Capacitor Bank Protection

	SEL-487V	SEL-352	SEL-451	SEL-487B	SEL-287V
APPLICATIONS					
Breaker Failure Protection, Number of Breakers	1	1	2	6	
Bus Differential				•	
Shunt Capacitor Bank Protection	•		ƒ		•
Low-Impedance Bus Differential				•	
Synchronism Check			•	•	
Underfrequency Load Shedding	ƒ		ƒ		
Undervoltage Load Shedding	ƒ	ƒ	ƒ	ƒ	•
PROTECTION					
27 Undervoltage	•	•	ƒ	•	•
32/37 Power Elements	•		ƒ		
46 Current Unbalance	•	•	ƒ	ƒ	
47 Voltage Unbalance	ƒ	•	ƒ	ƒ	
49 Equipment Thermal Monitoring	ƒ		ƒ		
50N/G Ground - O/C	•	•	•		
50P Phase - O/C	•	•	•	•	
50Q Negative-Sequence - O/C	•		•		
51N/G Ground Time - O/C	•		•		
51P Phase Time - O/C	•		•	•	
51Q Negative-Sequence Time - O/C	•		•		
59 Overvoltage	•	•	ƒ	•	•
81 Underfrequency/Overfrequency	•		ƒ		
87 Current Differential				•	
87V Voltage Differential	•	ƒ	ƒ		•
Single-Pole Trip			•	•	
Single-Pole Close			•		
Flashover Protection	•	•	•		
INSTRUMENTATION AND CONTROL					
79 Automatic Reclosing	ƒ	ƒ	•	ƒ	
SELOGIC® Control Equations	•	•	•	•	
25 Synchronism Check			•	•	
Voltage Check on Closing			•	•	
Nonvolatile Latch Control Switches	•	•	•	•	
Remote Control Switches	•	•	•	•	
Local Control Switches	•	•	•	•	
Display Points	•	•	•	•	
Multiple Settings Groups	•	•	•	•	
Substation Battery Monitor	•	*	•	•	
Breaker Wear Monitor	•	•	•		
Trip Coil Monitor	ƒ	ƒ	ƒ	ƒ	
Event Report (Multicycle Data)	•	•	•	•	•
Sequential Events Recorder	•	•	•	•	
Instantaneous Meter	•	•	•	•	•
Demand Meter	•		•		
SEL-2600 RTD Module Communications	•	*	•		
MISCELLANEOUS FEATURES					
Connectorized® (Quick Disconnect) Available	•	*			
IEEE C37.118 Synchrophasors	•		•		
Synchrophasor Real-Time Control	•		•		
IEC 61850	•		•	•	

• *Standard Feature*   ∗ *Model Option*

ƒ *This function may be created using settings or relay elements and timers*

SEL-487V

Protect and control grounded and ungrounded, single- and double-wye capacitor bank applications with the SEL-487V Capacitor Bank Protection Relay.

SEL-352

Provide comprehensive protection and unparalleled flexibility for breaker failure applications using the SEL-352 Breaker Failure Relay.

SEL-451

Combine directional overcurrent protection with complete control using the SEL-451 Protection, Automation, and Control System.

SEL-487B

Apply the SEL-487B Bus Differential and Breaker Failure Relay for busbar and breaker failure protection, automation, and control in applications with up to six terminals per relay.

SEL-287V

Protect and control power-factor correction capacitor banks with the SEL-287V Voltage Differential and Control Relay.

Networking and Communications

	SEL-3021-1	SEL-3021-2	SEL-3022	SEL-3031	SEL-2725	SEL-2890	SEL-2886
APPLICATIONS							
Protect Wired, Radio, Fiber, Dial-Up Serial SCADA Data Links From Intrusion	•						
Protect Wired, Radio, Fiber, Dial-Up Engineering Access Links From Intrusion	•	•					
Provide Wireless Point-to-Point Serial Link, Protected From Intrusion			•	∗			
Provide Three Point-to-Point Serial Links With One Radio Channel				•			
Provide Point-to-Multipoint Serial Radio Links				•			
Provide Encrypted and Authenticated Wireless Engineering Access Using Laptop Wi-Fi®, Protected From Intrusion				•			
Connect Multiple Wired-Ethernet Devices to Network					•		
Convert Wired 10/100BASE-T Ethernet Links to Fiber-Optic 100BASE-FX Ethernet Links					•		
Convert Serial EIA-232 Link to 10BASE-T Ethernet Link						•	
Multidrop	•	•				•	•
Mixed Mode			•				
Low Latency for SCADA Applications	•			•			
Convert EIA-232 Ports to EIA-485							•
Compatible With DNP[3], Modbus®, and Other Byte-Oriented Protocols	•	•	•	•		•	•
Combine to Convert and Protect Data for Ethernet			•			•	
FEATURES							
Encryption	•	•	•	∗			
Session Authentication	•	•	•	∗			
Message Authentication			•	•			
User-Based Accounts	•	•					
Logging		•					
FIPS 140-2 Level 2 Validated	•			∗			
915 MHz ISM Band Radio (Unlicensed)				•			
Wired 10BASE-T Ethernet Port; RJ-45 Jack						•	
Wired 10/100BASE-T Ethernet Port; RJ-45 Jack (Quantity)					4 or 3		
Fiber-Optic 100BASE-FX Ethernet Port; LC Connectors (Quantity)					1 or 2		
Wired EIA-232 Port; 9-Pin Subminiature D Connector (Quantity)	2	2	2	3		1	1
Wired EIA-485 Port; Compression Terminal Block							•
SETUP METHOD							
Encrypted and Authenticated Wireless Link	•	•	•				
USB Port	∗	∗		•			
EIA-232 Port						•	
Ethernet Link						•	
Control Switches							•

• *Standard Feature*   ∗ *Model Option*

SEL-3021

Protect serial data links against unauthorized access with the SEL-3021 Serial Encrypting Transceiver.

SEL-3022

Deploy the SEL-3022 Wireless Encrypting Transceiver in situations where communication is required, but pulling cable is not cost effective or practical.

SEL-3031

Wirelessly monitor and control remote systems using three secure data links with the SEL-3031 Serial Radio Transceiver in point-to-point or point-to-multipoint mode.

SEL-2725

Easily connect devices to Ethernet networks with the SEL-2725 Five-Port Ethernet Switch.

SEL-2890 and SEL-2886

Use Ethernet infrastructure for direct device communications with the SEL-2890 Ethernet Transceiver. Connect EIA-232 devices to an EIA-485 network with the SEL-2886 Interface Converter.

SEL-3620

The SEL-3620 Ethernet Security Gateway protects site-to-site Ethernet communications with IPsec VNP and secures your private networks with a substation-tough stateful firewall.

SEL-3610

Add up to 17 tough serial ports via Ethernet links with the SEL-3610 Port Server.

SEL ICON™

The SEL ICON Integrated Communications Optical Network is designed and built to address demanding communications needs and operate in extreme environments, including utilities, light-rail and highway transportation, manufacturing, petrochemical plants, pipelines, or anywhere reliable communication is required to support critical applications.

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# Computing

	SEL-3354
APPLICATIONS	
Use in Embedded Automation Systems	*
Collect, Scale Meter Data	*
Collect Targets, Contact Input Status, Fault Location	*
Run System in Harsh Environments	*
Control Through IED Outputs	*
Extract Data From Non-SEL IEDs	*
Forward Information to Maintenance Databases	*
Concentrate IED Data for:	
Distributed Control System (DCS)	*
SCADA Master or RTU	*
Local or Remote HMI	*
Convert SCADA Protocols	*
Configure System for Specific Application	•
Reseller/End User Adds Software	•
OPC Connectivity	*
Integrate With COTS Security Devices	*
Configure as Security Gateway to Help Satisfy NERC CIP Requirements	*
Create a Security Appliance by Loading Other Software	*
OPERATING SYSTEM	
Windows® Embedded Standard	*
Windows XP Professional	*
Windows 7	*
Windows 2008 Server	*
Linux®	*
None	•
SOFTWARE	
SEL Application Software	*
Other Third-Party Software	*
HARDWARE	
AMD Athlon™ 64 2600, 1.6 GHz, 64-Bit, 2 GB DDR2 SDRAM With ECC	•
Intel® Pentium® M, 1.4 GHz, 1 GB DDR SDRAM With ECC	*
Up to 16 EIA-232 Serial Ports (With IRIG-B and Configurable +5 V Source)	*
10/100 Mbps Independent Ethernet Ports	3
USB Ports (SEL-3354 is USB 2.0)	6
VGA Ports	2
Accept IRIG-B Time Synchronization	•
Provide IRIG-B Time Synchronization	•
Watchdog Processor	•
Dual CompactFlash® Slots	•
Solid-State Drive Mass Storage	*
PC/104-*Plus*, PCI-104 Module Support	•
PCI Expansion Slot	•
Wide Power Supply Ranges	•
Alarm Contact and Alarm LED	•
No-Moving-Parts Design	•
Withstands Vibration, Shock, and Other Extreme Situations	•
−40° to +75°C Operating Temperature Range	*
−20° to +60°C Operating Temperature Range	•

• *Standard Feature*   ∗ *Model Option*

SEL-3354

Apply the rugged SEL-3354 Embedded Automation Computing Platform to develop an application-specific system for harsh environments in commercial, industrial, or government systems.
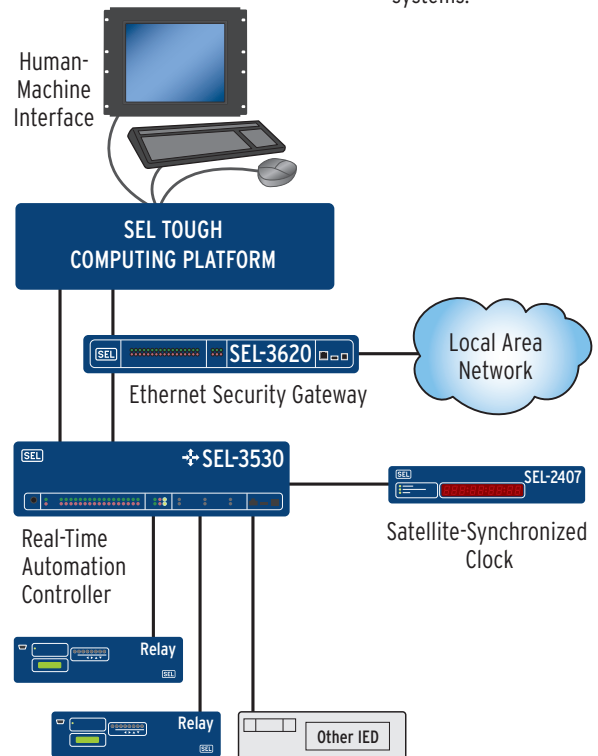
Information Processors

	SEL-3530	SEL-3530-4	SEL-2032	SEL-3332	SEL-3354	SEL-2020
APPLICATIONS						
Collect, Scale Meter Data	•	•	•	•	*	•
Collect Targets, Contact Input Status, Fault Location	•	•	•	•	*	•
Enable Fiber-Optic Links	•	•	•	•	•	•
Control Through IED Outputs	•	•	•	•	*	•
Extract Data From Non-SEL IEDs	•	•	•	•	*	•
Forward Information to Maintenance Databases	•	•	•	•	*	•
Accept IRIG-B Time Synchronization	•	•	•	•	•	•
Provide IRIG-B Time Synchronization	•	•	•	•	•	•
Concentrate IED Data for:						
Distributed Control System (DCS)	•	•	•	•	*	•
SCADA Master or RTU	•	•	•	•	*	•
Local or Remote HMI	•	•	•	•	*	•
Transparent "Port Switch"	•	•	•	•	*	•
Call Pager for Critical Conditions	•	•	•	•	*	•
Users Can Install Windows® Applications					•	
Web Server HMI	*	*			3	
FEATURES						
Primary and Standby LAN Support	•	•	1,2	•	•	
Programmable Logic Functions	•	•	•	•	*	•
Upgrade Firmware Through Port	•	•	•	•	•	
Optoisolated Inputs/Programmable Outputs	*	•	*			*
Telephone Connection Internal Modem						*
Rack-Mount or Panel-Mount Hardware	*	•	*	*	*	*
IEC 61131 Logic Engine	•	•			3	
Cybersecurity Management	•	•		•	•	
Real-Time Operating System	•	•	•			•
SERIAL PORT PROTOCOLS						
SEL Mirrored Bits® Communications	•	•				
Master						
DNP3	•	•		*	*	
Modbus® RTU	•	•		*	*	
Modbus Subset for IEDs			f			f
IEC 60870-5-103				*	*	
Harris 5000/6000				*	*	
LG 8979				*	*	
SES 92				*	*	
MV90 Master Subset for Meters	f	f	f			f
2179 for Tap-Changer Control	f	f	f			f
SEL Fast Messages, Interleaved With ASCII	•	•	•	•	*	•
SEL Synchrophasor	•	•	*			
Outstation						
DNP3	•	•	•	*	*	•
Modbus RTU Binary	•	•	•	*	*	•
IEC 60870-5-101/104				*	*	
Recon 1.1				*	*	
LG 8979				*	*	
Harris 5000/6000				*	*	
SES 92				*	*	
CDC Type 2 Byte				*	*	
GE-TAC/BE-TAC 7020				*	*	
Conitel 2020 Byte				*	*	
NETWORK PROTOCOLS						
Ethernet	•	•	1	•	•	
Telnet	•	•	1	•	•	
FTP	•	•	1	•	•	
DNP3 LAN/WAN	•	•	1	*	*	
Modbus TCP	•	•		•	*	
IEC 61850/UCA2			1	*	*	
IEC 61850				*	*	
IEC 61850 GOOSE	•	•		*	*	
OPC Client/Server				*	*	
IEEE C37.118 Client	•	•				
Modbus Plus®			2			
Lightweight Directory Access Protocol (LDAP)	•	•			3	

• *Standard Feature*   * *Model Option*   f *This function may be created using settings*

1 *With Ethernet Option*   2 *With Modbus Plus Option*

3 *Install and configure Windows applications*

SEL-3530

Apply the SEL-3530 Real-Time Automation Controller (RTAC) for real-time control and logic processing.

SEL-2032

Provide highly reliable, economical SCADA RTU functions with the SEL-2032 Communications Processor.

SEL-3332

Concentrate data, translate protocols, and securely provide enterprise connectivity for SCADA and station integration using the SEL-3332 Intelligent Server.

SEL-3354

Apply the rugged SEL-3354 Embedded Automation Computing Platform to develop an application-specific system for harsh environments in commercial, industrial, or government systems.

SEL-2020

Quickly and economically integrate any size station or plant with the SEL-2020 Communications Processor.

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Annunciation and Notification

	SEL-2533	SEL-2523	SEL-2522	SEL-3010
APPLICATIONS				
Local Visual Indication	●	●	●	
Remote Visual Indication	●	●		
Local Audible Indication	●	●	●	●
Remote Audible Indication	●	●	●	●
Loudspeaker Messages				●
Telephone Dial-Out Messages	●	●		●
Local SELOGIC® Control Equations and Time Tagging	●	●		
MOUNTING AND LABELING				
Surface/Wall Mount				●
Rack Mount		*	*	●
Panel Mount	●	*	*	
User-Defined Slide-In Labels	●	●	●	
INPUTS, OUTPUTS, AND HMI				
General-Purpose Digital Inputs	14*	42	36	
Acknowledge, Reset, Test Digital Inputs	4*	6	3	
General-Purpose Digital Outputs	14*	11	1	
Alarm Digital Output	1	1	1	
General Display LEDs/Windows	10	36	36	
Enabled LED	1	1	1	1
Pushbuttons	4	4	3	
Base Serial Ports	3	3		1
Optional Additional EIA-232 or EIA-485 Port	1	1		
IRIG-B Time Input	1	1		
ISA Annunciation Alarm Sequence Choices	All	6	2	
SERIAL COMMUNICATIONS PROTOCOLS				
SEL MIRRORED BITS® Communications	●	●		
SEL Fast Messages	●	●		
Send SEL Messenger Points	●	●		
Receive SEL Messenger Points				●
Modbus® RTU	●	●		
DNP3 Level 2 Outstation	*	*		

● *Standard Feature*   ∗ *Model Option*

SEL-2533

Use the compact ten-window SEL-2533 Annunciator for local and remote annunciation.

SEL-2523

Provide local and remote notifications with the SEL-2523 Annunciator Panel, including programmable logic and up to four communications ports.
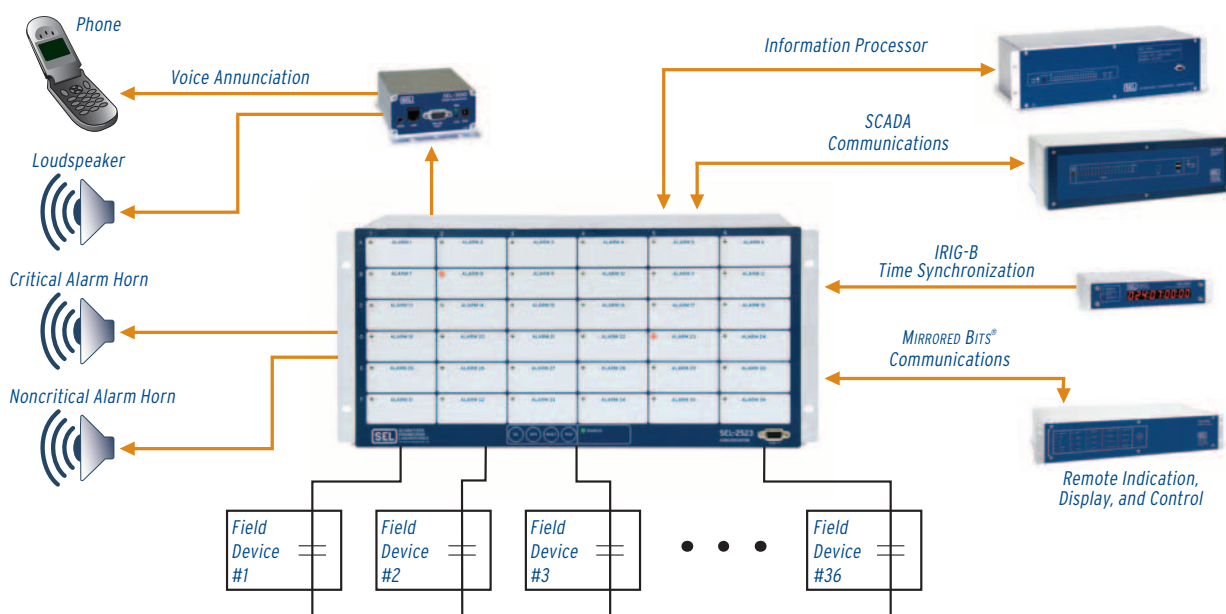
SEL-2522

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

SEL-3010

Deliver alarms and event notifications by telephone with the SEL-3010 Event Messenger.

The SEL-2523 Annunciator Panel in a distributed control application.

Phone

Voice Annunciation

Loudspeaker

Critical Alarm Horn

Noncritical Alarm Horn

Information Processor

SCADA Communications

IRIG-B Time Synchronization

MIRRORED BITS® Communications

Remote Indication, Display, and Control

Field Device #1

Field Device #2

Field Device #3

Field Device #36

Transformer Protection and Monitoring

	SEL-487E	SEL-387E	SEL-387	SEL-387A	SEL-787	SEL-587	SEL-2414
APPLICATIONS							
Breaker Failure Protection	•	ƒ	ƒ	ƒ	•	ƒ	ƒ
Transformer and Machine Current Differential	•	•	•	•	•	•	
Low-Impedance Bus Differential	•	•	•				
Underfrequency Load Shedding	•	ƒ			*		
Undervoltage Load Shedding	•	ƒ			*		
Three-Phase Current Inputs	5	3	4	2	2	2	*
PROTECTION							
24 Overexcitation (Volts Per Hertz)	•	•			•		
27 Undervoltage	•	•			•		
32/37 Power Elements	•				•		
46 Current Unbalance	•						
49 Equipment Thermal Monitoring	ƒ		*	•	•		
50N/G Ground - O/C	•	•	•	•	•	•	
50P Phase - O/C	•	•	•	•	•	•	
50Q Negative-Sequence - O/C	•	•	•	•	•	•	
51N/G Ground Time - O/C	•	•	•	•	•	•	
51P Phase Time - O/C	•	•	•	•	•	•	
51Q Negative-Sequence Time - O/C	•	•	•	•	•	•	
59 Overvoltage	•	•			•		
81 Underfrequency/Overfrequency	•	•			•		
87 Current Differential	•	•	•	•	•	•	
87G Restricted Earth Fault	•	•	•	*	*		
67P Directional Overcurrent	•						
Flashover Protection	ƒ	ƒ			ƒ		
INSTRUMENTATION AND CONTROL							
SELOGIC® Control Equations	•	•	•	•	•	•	•
Voltage Check on Closing	ƒ	ƒ			ƒ		
Transformer Cooling Fan Control	ƒ				ƒ		ƒ
Nonvolatile Latch Control Switches	•	•	•	•	•		•
Remote Control Switches	•	•	•	•	•	•	•
Local Control Switches	•	•	•	•	•		•
Display Points	•	•	•	•	•		•
Multiple Settings Groups	•	•	•	•	•		
Substation Battery Monitor	•	•	•	•			ƒ
Breaker Wear Monitor	•	•	•	•			
Trip Coil Monitor	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ	ƒ
Event Report (Multicycle Data)	•	•	•	•	•	•	•
Sequential Events Recorder	•	•	•	•	•		•
Instantaneous Meter		•	•	•	•	•	•
Demand Meter	•	•	•	•	•	•	•
Load and Temperature Profile Report	•				•		•
RTD (Resistance Temperature Detector) Inputs					*		*
Thermocouple Inputs							*
Through-Fault Monitor	•	•	*	•	•		•
Thermal Model/SEL-2600 RTD Module Communications	•		*	•	•		•
MISCELLANEOUS FEATURES							
Connectorized® (Quick Disconnect) Available		*	*			*	*

• *Standard Feature*   ∗ *Model Option*
ƒ *This function may be created using relay elements, device word bits, analog quantities, and timers*

SEL-487E
Apply the SEL-487E Transformer Protection Relay for comprehensive protection, metering, monitoring, and automation of power transformer applications.

SEL-387E
Use the SEL-387E Current Differential and Voltage Relay to provide comprehensive protection, metering, monitoring, and automation for transformers and other power apparatus.

SEL-387
Protect, monitor, and automate applications for transformers, generators, and other power apparatus with the SEL-387 Current Differential and Overcurrent Relay.

SEL-387A
Use the SEL-387A Current Differential and Overcurrent Relay for protection, monitoring, and automation applications for transformers and other power apparatus.

SEL-787
Apply advanced protection and monitoring with flexible communications to transformer applications with the SEL-787 Transformer Protection Relay.

SEL-587
Provide inexpensive differential protection for transformers or other apparatus with the SEL-587 Current Differential Relay.

SEL-2414
Apply the SEL-2414 Transformer Monitor for complete system monitoring and control of new and existing transformers.

Transmission Line Protection

	SEL-421	SEL-311A	SEL-311B	SEL-311C	SEL-311L	SEL-387L	SEL-311M	SEL-321	SEL-451	SEL-351
APPLICATIONS										
Distance Protection	•	•	•	•	•			•		
Breaker Failure Protection	•	f	f	f	f		f	f	•	f
Automatic Reclosing	•		•	•	•			f	•	•
Synchronism Check	•		•	•	•			•	•	•
Undervoltage Load Shedding	f		f	f	f		f	f	f	f
Line Current Differential					•	•	•			
Synchrophasors	•	•	•	•	•				•	•
PROTECTION										
21G Mho Ground Distance	•	•	•	•	•			•		
21XG Quad Ground Distance	•			•	•			•		
21P Mho Phase Distance	•	•	•	•	•			•		
27 Undervoltage	f		•	•	•		•	•	f	•
49 Thermal	f								f	
50N/G Ground - O/C	•	•	•	•	•		•	•	•	•
50P Phase - O/C	•	•	•	•	•		•	•	•	•
50Q Negative-Sequence - O/C	•	•	•	•	•		•	•	•	•
51N/G Ground Time - O/C	•	•	•	•	•		•	•	•	•
51P Phase Time - O/C	•	•	•	•	•		•	•	•	•
51Q Negative-Sequence Time - O/C	•		•	•	•		•	•	•	•
59 Overvoltage	f		•	•	•		•	•	f	•
67N/G Ground Directional - O/C	•	•	•	•	•		•	•	•	•
67P Phase Directional - O/C	•	•	•	•	•		•	•	•	•
67Q Negative-Sequence Directional - O/C	•		•	•	•		•	•	•	•
87L Line Current Differential					•	•	•			
Sensitive Earth Fault (SEF)							•			*
Programmable Analog Math	•								•	
Out-of-Step Block and Trip	•			•	•			•		
Load-Encroachment Supervision	•	•	•	•	•		•	•	•	•
Switch-Onto-Fault	•	•	•	•	•		•	•	•	•
Single-Pole Trip	•			*	*			•		
MIRRORED BITS Communications	•	•	•	•	•		•	•	•	•
Zone/Level Timers	•	•	•	•	•		•	•	•	•
Pilot Protection Logic	•		•	•	•		•	•	•	•
INSTRUMENTATION AND CONTROL										
79 Automatic Reclosing	•	f	•	•	•			f	•	•
Number of Controlled Breakers	2	1	1	1	1	1	1	1	2	1
Fault Locating	•	•	•	•	•			•	•	•
SELOGIC Control Equations	•	•	•	•	•		•	•	•	•
25 Synchronism Check	•		•	•	•		•	•	•	•
81 Underfrequency/Overfrequency	•		•	•	•		•		f	•
Nonvolatile Latch Control Switches	•	•	•	•	•		•	•	•	•
Remote Control Switches	•	•	•	•	•		•	•	•	•
Local Control Switches	•	*	*	*	•		•		•	•
Display Points	•	*	*	*	•		•		•	•
Advanced MIRRORED BITS Communications	•								•	
Substation Battery Monitor	•	•	•	•	•	•	•		•	•
Breaker Wear Monitor	•	•	•	•	•		•		•	•
Trip Coil Monitor	f	f	f	f	f		f	•	f	f
Event Report (Multicycle Data)	•	•	•	•	•	•	•	•	•	•
Sequential Events Recorder	•	•	•	•	•	•	•	*	•	•
Instantaneous Meter	•	•	•	•	•	•	•	•	•	•
DNP3 Level 2 Outstation	•	*	*	•	*	•		*	•	•
IEC 61850 Communications	*			*	*				*	
Synchrophasors (SEL Format)	•	•	•	•	•				•	
Synchrophasors (IEEE C37.118 Format)	•			•					•	•
MISCELLANEOUS FEATURES										
Accepts Delta Voltage Transformers				•						•
Connectorized (Quick Disconnect) Available	*	*	*	*				*	*	*
Configurable Labels	•								•	*

• *Standard Feature*　∗ *Model Option*　f *This function may be created using settings.*

SEL-421
Apply innovative line protection as part of a comprehensive station automation package with the SEL-421 Protection, Automation, and Control System.

SEL-311A
Implement backup distance protection at very low cost with the SEL-311A Phase and Ground Distance Relay.

SEL-311B
Create step distance protection using the SEL-311B Distance Relay With Recloser with four-shot reclosing and synchronism check elements.

SEL-311C
Apply the SEL-311C Advanced Distance Relay With Recloser for three-pole distance protection, reclosing, monitoring, and control of transmission lines.

SEL-311L
Use the SEL-311L Line Current Differential System with full-scheme backup for easy-to-apply, high-speed line protection.

SEL-387L
Use the SEL-387L Line Current Differential Relay for economical, easy-to-apply line protection with zero settings.

SEL-321
Select the SEL-321 Phase and Ground Distance Relay for complete distance protection, including single-pole tripping and series-compensated lines.

SEL-279H
Use the SEL-279H Reclosing Relay for one or two breakers, including synchronism checking and voltage checking for single-pole or three-pole trip applications.

# Fiber-Optic Devices

Fiber-Optic Transceivers

	SEL-2800	SEL-2810	SEL-2812	SEL-9220	SEL-2814	SEL-2815	SEL-2829	SEL-2830	SEL-2831	SEL-2894	SEL-3094
CONNECTOR AND OPTICS											
V-System®, 650 nm Wavelength	•	•									
ST®, 850 nm Wavelength			•	•	•	•				•	•
ST, 1300 nm Wavelength							•	•			
ST, 1550 nm Wavelength									•		
FIBER COMPATIBILITY											
200 µm Core Multimode Fiber (SEL-C805)	•	•	•	•	•	•					
50 or 62.5 µm Core Multimode Fiber (SEL-C807, -C808)			•	•	•	•				•	•
9 µm Core Single-Mode Fiber (SEL-C809)							•	•	•		
ELECTRICAL											
EIA-232 Asynchronous Serial Data	•	•	•		•	•				•	*
EIA-485 Asynchronous Serial Data											*
EIA-422, EIA-485 Synchronous Serial Data											*
ITU-T G.703 Synchronous 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					•					•	•

Serial Fiber-Optic Devices

	SEL-2126	SEL-2505	SEL-2506	SEL-2515	SEL-2516	SEL-2594/2595	SEL-2431/2440/2600	SEL-2664	SEL-701	SEL-700G/710/751A/787/2411/2414/2440	SEL-311L/387L[8]	SEL-2407
CONNECTOR, OPTICS, AND ENCODING												
V-System Connector, 650 nm Wavelength — Data: SEL-2800 Compatible		1	1	1	1	1			•			
ST Connector, 850 nm Wavelength — Data Plus IRIG-B: SEL-2812/SEL-9220 Compatible		2	2			2		•		2		2
ST Connector, 850 nm Wavelength — Data: SEL-2815 Compatible		3	3	3	3							
ST Connector, 1300 nm Wavelength — Data: SEL-2829 Compatible			4		4							
ST Connector, 1300 nm Wavelength — Data: SEL-2830 Compatible		5	5	5	5							
ST Connector, 1550 nm Wavelength — Data: SEL-2831 Compatible			6									
ST Connector, 850 nm Wavelength — Data: SEL-3094 Compatible	•					•					7	
FIBER COMPATIBILITY												
200 µm Core Multimode Fiber (SEL-C805)	2	1,3	1,3	1,3	1,3		1,2	•	•			2
50 or 62.5 µm Core Multimode Fiber (SEL-C807, -C808)	2	2,3	3	2,3	3	•	2			•	7,8	2
9 µm Core Single-Mode Fiber (SEL-C809)		5	4,5,6	5	4,5							

Ethernet Fiber-Optic Devices

	SEL-2032	SEL-3332	SEL-3351/1102	SEL-3306	SEL-2725	SEL-421/451/487B/487E	SEL-311L/387E/351	SEL-787/2411/2440
CONNECTOR AND ENCODING								
ST Connectors 10BASE-FL	*					*		
ST Connectors 100BASE-FX	*	•	•	•		*		
LC Connectors 100BASE-FX					•		*	*
FIBER COMPATIBILITY								
50 or 62.5 µm Core Multimode Fiber	*	•	•	•	*	*	*	*
9 µm Core Single-Mode Fiber					*			
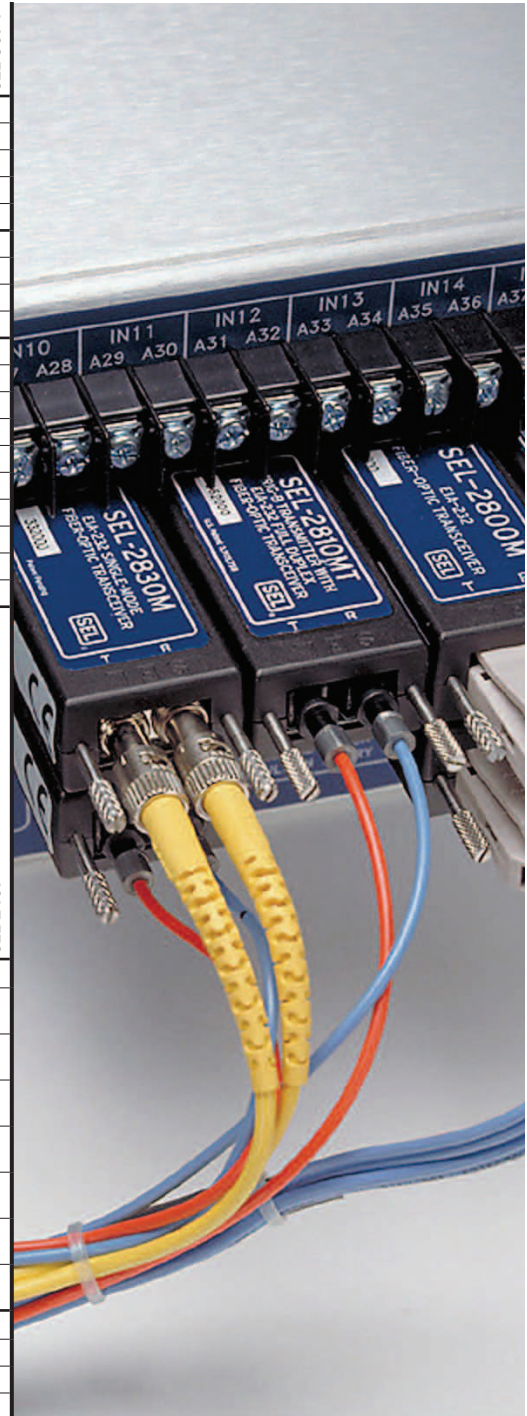
• *Standard Feature*   * *Model Option*

Notes:

1 = With SEL-2800 Compatible Option
2 = With SEL-2812 Compatible Option
3 = With SEL-2815 Compatible Option
4 = With SEL-2829 Compatible Option
5 = With SEL-2830 Compatible Option
6 = With SEL-2831 Compatible Option
7 = With SEL-3094 Compatible Option
8 = Line Current Differential 1300 nm and 1550 nm Options Available

Precise Time

Clocks

	SEL-2401	SEL-2404	SEL-2407®	SEL-3401
APPLICATIONS				
Substation Time Automation	•	•	•	
Industrial Time Automation	•	•	•	
Synchrophasor Time Standard	•	•	•	
Control Room Viewing		•	•	•
Large-Area Viewing		•		•
Recloser Timing Source	•		•	
IEEE 1344/IEEE C37.118 Time-Quality Testing	•	•	•	
Synchronized Clock Systems	•	•	•	•
TIMEKEEPING AND DISTRIBUTION				
Accuracy ±100 ns (Average)	•	•	•	
Demodulated IRIG-B	•	•	•	•
Modulated IRIG-B			•	
GPS Satellite Tracking	•	•	•	
Multiple Channel Outputs		•	•	∗
Single Channel Outputs	•			∗
INSTRUMENTATION AND CONTROL				
Time-Synchronized Event Reporting	•	•	•	
Source for Time-Tagged SER	•	•	•	
Internal Battery Backup			•	•
Large-Distance Viewing 60.96 m (200 ft)		•		•
FEATURES				
High-Gain GPS Antenna and Feedline	•	•	•	
Large, 76.2 mm (3.0 in) LED Display		•		•
14 mm (0.56 in) LED Display			•	
Meets IEEE C37.90 and IEC 60255 Surge and Environmental Standards	•	•	•	•
Force-Time-Quality Mode (for Testing)			•	
Rack-Mount, Panel-Mount, or Wall-Mount Hardware	•	•	•	•
Synchronized Pulse Output	•	•	•	
Universal Power Supply			•	
SERIAL-PORT PROTOCOLS				
ASCII Commands and Reports	•	•	•	
Fiber Communications Port			∗	

• *Standard Feature* ∗ *Model Option*

SEL-2401

Apply the low-priced SEL-2401 Satellite-Synchronized Clock everywhere you can use accurate time.

SEL-2404

Apply the SEL-2404 Satellite-Synchronized Clock with relays, event recorders, and information processors in applications requiring accurate time and highly visible time indication.

SEL-2407®

Apply the SEL-2407 Satellite-Synchronized Clock with relays, Sequential Events Recorders, communications processors, and other devices for precise alignment of time-sensitive information.

SEL-3401

Install the SEL-3401 Digital Clock to improve productivity, using a large time display in control rooms, factories, and other time-critical locations.

I/O Processors and Controllers

	SEL-2411	SEL-2440	SEL-2505	SEL-2506	SEL-2515	SEL-2516	SEL-2594	SEL-2595	SEL-2600
APPLICATIONS									
Save Wiring Via I/O Multiplexing	•	•	•	•	•	•	•	•	•
I/O for SEL Relays/SEL-3530/SEL-2100	•	•	A	A					A
I/O for Information Processors	•	•			A	A			A
Transfer I/O to SEL-2505/2506	•	•	•	•					
Transfer I/O to SEL-2594/2595							•	•	
Teleprotection	•	•	•	•			•	•	
Automatic Local Control Logic	•	•							
Improve Safety With Optical Fiber	*	*	•	•	•	•	•	•	•
MOUNTING AND LABELING									
Surface/Wall-Mount	*	•	•		•		•		•
Rack-Mount	*	•		*		*		*	
Panel-Mount	*	•		*		*		*	
Projection Panel-Mount	*			*		*		*	
User-Configurable Labels	•			•		•		•	
Screw-Terminal Connectorized® Blocks				•		•		•	
NUMBER OF INPUT/OUTPUT CHANNELS									
Digital Inputs (DI) Base	2	32	8	8	8	8	8	8	1
DI Maximum	34	48	8	8	8	8	8	8	1
Digital Outputs (DO) Base	3	16	8	8	8	8	8	8	
DO Maximum	35	32	8	8	8	8	8	8	
DC Analog Inputs (AI) Maximum	32								
DC Analog Outputs (AO) Maximum	4								
AC Current Inputs/CT Maximum	7								
AC Voltages/VT Maximum	3								
DC Analog RTD Inputs Maximum	10								12
DC Analog Thermocouple Inputs Maximum	10								
SERIAL COMMUNICATIONS PROTOCOLS									
SEL Mirrored Bits®	•	•	•	•					
SEL Fast Messages	•	•			•	•			•
Modbus® RTU	•	•							
IEEE C37.94							•	•	
DNP3	*	•							
ETHERNET COMMUNICATIONS PROTOCOLS									
Modbus TCP	*	•							
DNP3 LAN/WAN	*	•							
Telnet	*	•							
FTP	*	•							
IEC 61850	*	*							

• *Standard Feature*   * *Model Option*
A *With compatible SEL fiber-optic transceiver or interface option at relay or processor*

SEL-2411

The SEL-2411 Programmable Automation Controller (PAC) offers flexible I/O for automatic control, SCADA, station integration, remote monitoring, and plant control systems.

SEL-2440

Apply the SEL-2440 Discrete Programmable Automation Controller (DPAC) for utility-grade I/O, powerful processing, flexible communications, and micro-second timing.

SEL-2505/SEL-2515

Reduce operating time, add self-wiring, and simplify wiring for auxiliary inputs and outputs with the SEL-2505/SEL-2515 Remote I/O Module.

SEL-2506/SEL-2516

Apply the SEL-2506/SEL-2516 Rack-Mount Remote I/O Module for SCADA and station integration.

SEL-2594

Securely transfer contacts through the high-speed, IEEE C37.94 optical fiber interface with the SEL-2594 Contact Transfer Module.

SEL-2595

Securely transfer teleprotection signals through the high-speed, IEEE C37.94 optical fiber interface with the SEL-2595 Teleprotection Terminal.

SEL-2600

Acquire and transmit resistance temperature detector (RTD) thermal data from transformers, motors, generators, and other system apparatus with the SEL-2600 RTD Module.

SELect™ I/O Card Options

	SEL-710	SEL-749M	SEL-751A	SEL-787	SEL-2411	SEL-2414
8 DIGITAL INPUT (SELect 8 DI)						
Digital Input Voltage						
125 Vdc/Vac	*	*	*	*	*	*
24 Vdc/Vac	*	*	*	*	*	*
48 Vdc/Vac	*	*	*	*	*	*
110 Vdc/Vac	*	*	*	*	*	*
220 Vdc/Vac	*	*	*	*	*	*
250 Vdc/Vac	*	*	*	*	*	*
8 DIGITAL OUTPUT (SELect 8 DO)						
Electromechanical Form A DO					*	*
Electromechanical Form B DO					*	*
4 DIGITAL INPUT/4 DIGITAL OUTPUT (SELect 4 DI/4 DO)						
Digital Input Voltage - Output Type						
125 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
24 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
48 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
110 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
220 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
250 Vdc/Vac DI - Electromechanical DO	*		*	*	*	*
125 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
24 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
48 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
110 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
220 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
250 Vdc/Vac DI - Fast Current Interrupting DO	*		*	*	*	*
3 DIGITAL INPUT/4 DIGITAL OUTPUT/14–20 MA ANALOG OUTPUT (SELect 3 DI/4 DO/1 AO)						
Digital Input Voltage - Output Type						
125 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
24 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
48 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
110 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
220 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
250 Vdc/Vac DI - Electromechanical DO	*	*	*	*		
8 ANALOG INPUT (SELect 8 AI)						
8 ±20 mA or ±10 V, Jumper Selectable	*		*		*	*
4 Std Range Inputs, ±20 mA or ±10 V, Jumper Selectable 4 Ext Range Inputs, ±300 V only, No Current					*[1]	*
4 ANALOG INPUT/4 ANALOG OUTPUT (SELect 4 AI/4 AO)						
±20 mA or ±10 V, Jumper Selectable Note: Only One (1) - 4 AI/4 AO Card Per Chassis	*		*	*	*	*
10 RTD/THERMOCOUPLE INPUT CARD (SELect 10 RTD)						
RTD Temperature Input	*		*	*	*[1]	*
RTD/TC Temperature Input					*[1]	*[3]
4 AC CURRENT INPUT (SELect 4 ACI)						
1 A Phase, 1 A Neutral	*	*	*	*		
1 A Phase, 5 A Neutral	*	*	*	*		
1 A Phase, 2.5 mA High Sense Neutral	*		*	*		
5 A Phase, 5 A Neutral	*	*	*	*		
5 A Phase, 1 A Neutral	*	*	*	*		
5 A Phase, 2.5 mA High Sense Neutral	*		*	*		
3-PHASE AC VOLTAGE INPUT (SELect 3 AVI)						
300 Vac Maximum	*	*	*	*		
3 AC CURRENT/3-PHASE AC VOLTAGE INPUT (SELect 3 ACI/3 AVI)						
Voltage: 300 Vac Maximum (Motor Differential) Current: 1 A/5 A	*[2]					
Voltage: 8 Vac Maximum Current: 5 A					*[1]	*
With AMS Connector Voltage: 8 Vac Maximum Current: 5 A					*[1]	*
Voltage: 300 Vac Maximum Current: 5 A					*[1]	*
With AMS Connector Voltage: 300 Vac Maximum Current: 5 A					*[1]	*

	SEL-710	SEL-749M	SEL-751A	SEL-787	SEL-2411	SEL-2414
6 AC CURRENT INPUT (SELect 6 ACI)						
1 A Winding 1, 1 A Winding 2				*		
1 A Winding 1, 5 A Winding 2				*		
5 A Winding 1, 5 A Winding 2				*		
1 AC CURRENT/3-PHASE AC VOLTAGE INPUT (SELect 1 ACI/3 AVI)						
Voltage: 300 Vac Maximum Current: 1 A Neutral				*		
Voltage: 300 Vac Maximum Current: 5 A Neutral				*		
1 AC CURRENT (SELect 1 ACI)						
Current: 1 A Neutral			*			
Current: 5 A Neutral			*			
4 DIGITAL INPUT/3 DIGITAL OUTPUT (SELect 4 DI/3 DO) (2 FORM C AND 1 FORM B)						
24 Vdc/Vac Digital Input					*	*
48 Vdc/Vac Digital Input					*	*
110 Vdc/Vac Digital Input					*	*
125 Vdc/Vac Digital Input					*	*
220 Vdc/Vac Digital Input					*	*
250 Vdc/Vac Digital Input					*	*
POWER SUPPLY 125/250 VDC/VAC (SELect PS10/2DI/3 DO)						
Digital Input Voltage						
125 Vdc/Vac Digital Input	*	*	*	*	*	*
24 Vdc/Vac Digital Input	*	*	*	*	*	*
48 Vdc/Vac Digital Input	*	*	*	*	*	*
110 Vdc/Vac Digital Input	*	*	*	*	*	*
220 Vdc/Vac Digital Input	*	*	*	*	*	*
250 Vdc/Vac Digital Input	*	*	*	*	*	*
POWER SUPPLY 24/48 VDC/VAC (SELect PS10/2DI/3 DO)						
Digital Input Voltage						
125 Vdc/Vac Digital Input	*	*	*	*	*	*
24 Vdc/Vac Digital Input	*	*	*	*	*	*
48 Vdc/Vac Digital Input	*	*	*	*	*	*
110 Vdc/Vac Digital Input	*	*	*	*	*	*
220 Vdc/Vac Digital Input	*	*	*	*	*	*
250 Vdc/Vac Digital Input	*	*	*	*	*	*
SERIAL COMMUNICATIONS CARD (SELect EIA-232/EIA-485)	*	*	*	*	*	*
EIA-485 DEVICENET™ COMMUNICATIONS CARD (SELect DEVICENET)	*	*	*	*		
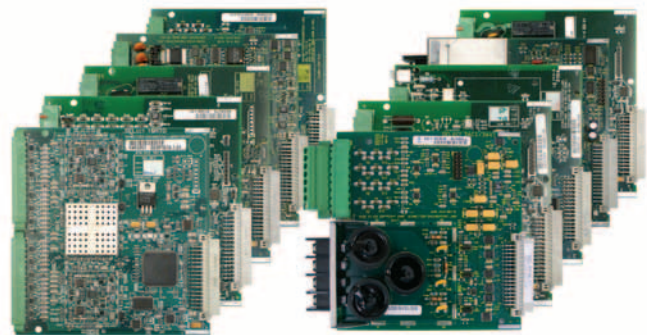
* *Model Option*
1 *Requires Firmware Revision 2XX or Higher*
2 *Requires R201 or Higher Firmware*
3 *Requires Firmware Version R302 or Higher*

Conformal coating optional on all cards.
Unless otherwise specified, all digital outputs are Form A.

Software Selection Guide

Design and Engineering

ACSELERATOR QuickSet Designer® SEL-5031 Software
Create and edit QuickSet Design Templates for use by ACSELERATOR QuickSet® SEL-5030 Software.

SEL-5802 Motor Modeling Program
Model thermal behavior of induction motors.

SEL-5801 Cable Selector Program
Select cable to connect devices.

SEL-5804 Curve Designer
Design user-defined, time-overcurrent curves for SEL-351R Recloser Controls. Download from **www.selinc.com**.

SEL-5806 Curve Designer
Design user-defined, volts-per-hertz curves for SEL-387E Current Differential and Voltage Relays. Download from **www.selinc.com**.

ACSELERATOR Architect® SEL-5032 Software
Design and commission IEC 61850 solutions that include SEL IEDs.

Settings and Configuration

ACSELERATOR QuickSet® SEL-5030 Software
Use Settings Editors or QuickSet Design Templates to create and edit device settings. Manage settings for multiple devices.

SEL-5020 Settings Assistant Software
Create and edit communications processor settings.

SEL-5809 Settings Software
Use settings software for SEL-3021-1 Serial Encrypting Transceivers and SEL-3022 Wireless Encrypting Transceivers.

SEL-5860 Time Service Software
Turn your SEL satellite-synchronized clock into a network time source. Free download, works with SEL-2401, SEL-2404, and SEL-2407 Satellite-Synchronized Clocks.

Data Retrieval and Analysis

ACSELERATOR Report Server® SEL-5040 Software
Automatically retrieve, save, and summarize event reports from SEL devices.

ACSELERATOR Report Viewer® SEL-5042 Software
View event reports and summary files remotely from computers on the same network as a PC executing ACSELERATOR Report Server.

Event Waveform Viewer
Built into SEL-5040, SEL-5030, and SEL-5031 to view event reports as oscillograms.

ACSELERATOR Analytic Assistant® SEL-5601 Software
Display graphical event reports using many features and views.

SEL-5076 SYNCHROWAVE® Archiver Software
Store data in either COMTRADE or text format. Choose the number of channels, the data rate, and the length of storage to fit your needs.

SEL-5077 SYNCHROWAVE Server Software
Automatically retrieve, concentrate, and publish synchronous phasor measurement data.

SEL-5078 SYNCHROWAVE Console Software
Visualize and archive synchronous phasor measurement data for wide-area system analysis.

SEL-5810 Virtual Serial Software
Encrypted serial port software for SEL-3022 Wireless Encrypting Transceivers.

SEL-5045 ACSELERATOR TEAM™ Software
Systematize and integrate your system data and assets using the TEAM Software solution.

ACSELERATOR QuickSet®
SEL-5030 Software

*Reduce the time required
to program settings.*

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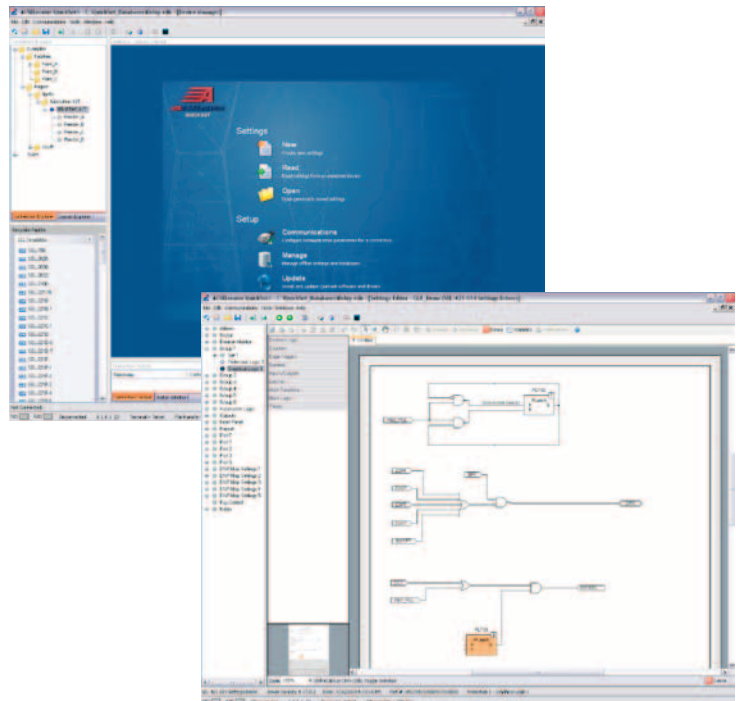
Software Applications

Most SEL products include application software, which dramatically reduces acquisition, operating, and maintenance expenses.

	SEL-5020 Settings Assistant	AcSELerator QuickSet SEL-5030 (free download)[1]	AcSELerator QuickSet Designer SEL-5031	AcSELerator Team SEL-5045	AcSELerator Analytic Assistant SEL-5601*	SEL-5801 Cable Selector Program
APPLICATIONS						
Manage Relay Settings Database		•	•	•		
Remote Relay Access		•	•	•		
Design and Engineering Software			•			•
Settings and Configuration Software	•	•	•			
Data Retrieval and Analysis Software				•	•	
Waveform Viewer		•	•	•	•	
FEATURES						
Create and Edit AcSELerator QuickSet Design Template			•			
Settings Editor - Create and Edit Device Settings		•	•			
Design Templates - Create and Edit Device Templates		•	•			
Manage Settings for Multiple Devices		•	•	•		
Auto Retrieve, Save, and Summarize Event Reports				•		
View Event Reports and Summary Files Remotely				•		
Display Graphical Event Reports		•	•	•	•	
Manually Develop SELogic® Control Equations	•	•	•	•		
Automatically Generate Graphical Logic Elements		•	•			
View Graphical Logic		•	•			
MISCELLANEOUS FEATURES						
Single-User Support	•	•	•	•		
Multiple-User Support		•	•	•		
SEL Relay Settings Database		•	•			
Customized Reporting		•	•	•		
Advanced Graphical Logic		•	•			
Multithreaded Application				•		
Tiered Architecture		•	•	•		
SQL Database Support		•	•	•		
Customized Scripting		•	•	•		
Windows® Service Enabled				•		
Integrated Simple HMI		•	•			
Integrated Freeform Logic Editor		•	•			
Integrated Firmware Manager		•	•			
SEL Compass® Updates	•	•	•	•	•	

• *Standard Feature*

* *Part of AcSELerator Team; AcSELerator Analytic Assistant also sold separately.*

[1] *Download this complimentary software from www.selinc.com/SEL-5030.*
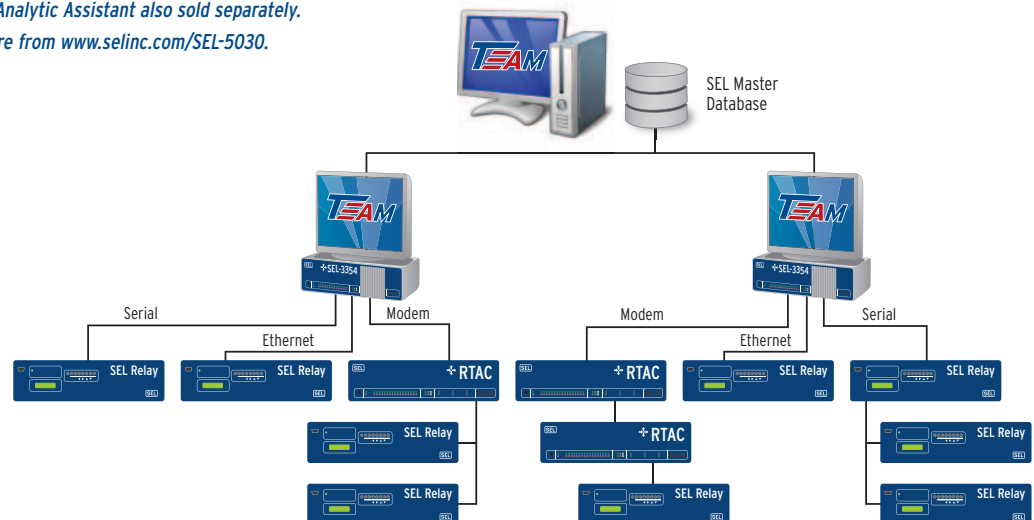
Fault Indicating and Sensing

Fault Indicators

SEL fault indicators improve safety and system reliability by helping to identify fault locations faster. Compact construction simplifies installation, with strong clamping mechanisms to fit different conductor sizes. Choose from overhead and underground models with a variety of display options.

Overhead AutoRANGER®

The AR360—Overhead AutoRANGER indicates permanent and temporary faults with 360° visibility intelligent display.

Underground AutoRANGER

The AR-URD—Underground AutoRANGER is available with remote displays.

Test Point Reset Fault Indicator

The TPR—Test Point Reset Fault Indicator is the most economical fault-indicating solution for elbow test point applications.

Underground Display Options

BEACON Bolt® Display

Three-Phase "3" Display (BEACON® also available)

Large "L" Display (BEACON also available)

RadioRANGER® Wireless Fault Indication System

Reduce fault-finding time in subsurface vault applications. Communicate subsurface fault-indicator status to street-level personnel.

Remote Fault Reader

RadioRANGER Interface Probe

Fault Indicator

Paper-Insulated Lead Cable (PILC) Fault Indicator

Wireless Interface

Also a Great Solution for Pad-Mounted Enclosures

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Engineering Services Overview

SEL Engineering Services

- Protection and Automation Services
- Engineering Studies and Analysis
- General Engineering Services
- Automation and Integration Systems
- POWERMAX® Power Management and Control System
- Electrical System Coordination and Design

SEL Complete Solutions

- Custom Panels
- POWERCORE™ Substation Control Enclosures

Engineering Services

Economical, Innovative Systems and Engineering Services

SEL provides cost-effective engineering, procurement, and construction (EPC) capabilities and delivers complete turnkey solutions. SEL also offers engineering services to support the application and operation of SEL equipment and other intelligent electronic devices (IEDs). These services fill a growing need as companies deal with the impacts of smaller engineering staffs and increasingly complex requirements for protecting, automating, and controlling their power systems. Industrial and commercial customers, consultants, contractors, and other IED integrators work with SEL Engineering Services.

SEL engineers have field experience and engineering expertise in providing application-specific solutions for electric power systems. SEL provides products and services that cover complete power system protection, integration, and automation. Many projects are currently installed and commissioned in industrial and electric utility facilities around the world. SEL has contracted more than 100 complete turnkey control enclosures and over 1,000 engineering services projects.

Protection and Automation Services

- Protection and Automation Scheme Design
- Relay and Information Processor Settings
- Communications Architecture Design and Programming
- Human-Machine Interface (HMI) Design and Programming

Engineering Studies and Analysis

- Model Power System Testing
- Arc-Flash Hazard Studies
- Asset Optimization Services
- Fault and Coordination Studies

General Engineering Services

- Project Scope and Specification
- Engineering Design and Drafting Services
- Substation EPC
- Field Testing and Commissioning

Automation and Integration Systems

- Distribution Automation
- Distributed Capacitor Bank Control System
- SEL-7000 Integration Substation System
- SCADA
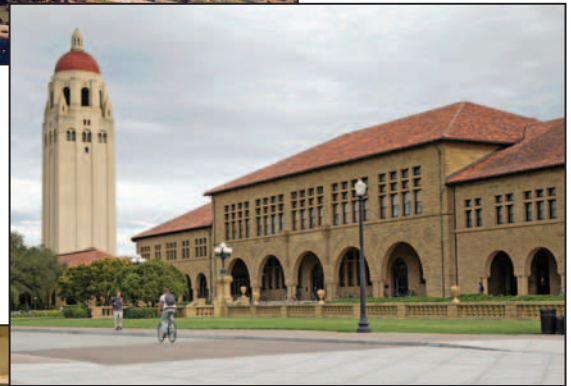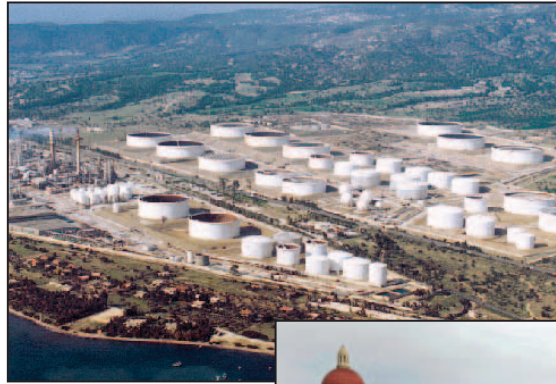
"The SEL engineers provided excellent product support during all phases of our project — design, construction, training, and documentation. We were very satisfied with the entire package SEL provided."

Mike Svasta
Peters, Tschantz, and Bandwen, Inc.

Engineering Services

Electrical System Coordination and Design

- Scheme Design
- Fault and Coordination Studies
- Relay Settings
- HMI Design and Programming
- Communications Architecture Design and Programming
- Real-Time Digital Power System Simulation
- Electrical System EPC
- Asset Optimization Services
- Engineering Design and Drafting Services
- Project Scope Development and Specification
- Field Testing and Commissioning

SEL Engineering Services Successes

- Motor Oil Hellas Corinth Refineries S.A., Greece
- Stanford University, USA
- British Petroleum
- Chevron Corporation
- Abbott Laboratories, USA
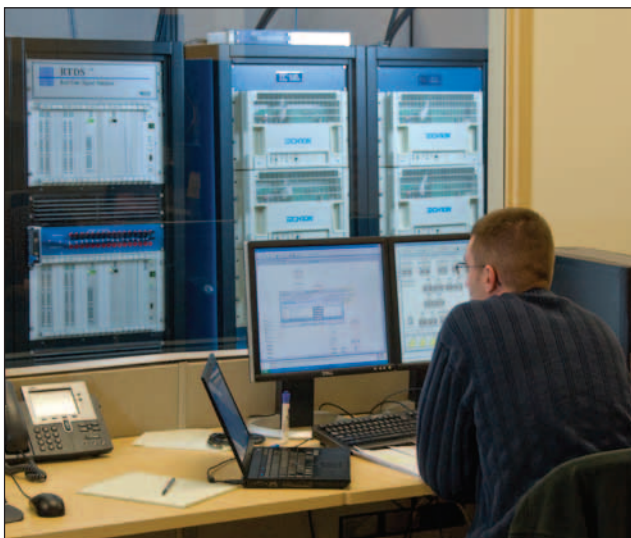
SEL POWERMAX® Power Management and Control System

The SEL POWERMAX Power Management and Control System is designed specifically for customers with on-site generation and/or significant imported (purchased) power. POWERMAX contains automated control functions specifically designed to prevent, detect, and mitigate system blackouts. Automated functions within POWERMAX control major power system assets for optimal economic operation. By properly collecting, manipulating, and presenting power system data as usable information, the SEL POWERMAX system enables operators, maintenance, and engineering staff to diagnose system events, predict equipment failures, and minimize unnecessary maintenance. POWERMAX technology is ideal for oil and petrochemical refining operations, pulp and paper manufacturing facilities, mining and metals-processing facilities, water and wastewater treatment plants, data centers, or any other production facility with an islanded, multisource, or distributed-generation power system.

Key Benefits

Maximize System Uptime

Mitigate problems before you experience an outage with proactive, high-speed load shedding, generation control, voltage control, and load management.

Increase Reliability With a Robust, Multifunction System

Perform protection, control, automation, and management functions with one system consisting of high-quality hardware and software.

Provide Total System Awareness

Reduce analysis time through graphical user interfaces, automatic waveform capture collection, report analysis software, and report generation tools.

Optimize Maintenance Schedules

Base preventive maintenance on actual performance statistics rather than periodic time schedules. Detect the earliest signs of failure using trended motor operating statistics, instantaneous quantities, and harmonic components.

Trusted Technology

The SEL POWERMAX System is a complete power management and control system. POWERMAX includes protective relays, power quality monitoring capabilities, revenue metering, serial and Ethernet communications processing, substation-hardened computing platforms, an IEC 61131-3 programming environment, and a fully redundant-server-based data acquisition and monitoring system.

POWERMAX Systems include robust, easy-to-use software that SEL makes available without license or support fees to substantially reduce system acquisition and maintenance expenses. SEL software controls every aspect of the power system and includes digital fault recording (oscillography) features, fault data analysis capabilities, sequence-of-events recording (SER), SER analysis tools, protective relay settings management software, and communications systems management software.

The POWERMAX communications architecture can support low-latency time-division multiplexing (TDM) and triple-contingency, substation-hardened, Ethernet switching network topologies. POWERMAX employs remote virtual private network (VPN) administrative access and satellite-based time synchronization of all electronic devices.

SEL POWERMAX Power Management and Control System

System Capabilities

SEL's Generation Control System regulates generator power outputs and manages utility interties to maximize system stability, minimize electrical disturbances, and mitigate load shedding requirements.

Automatic Generation Control (AGC) regulates generator outputs to maintain the power interchange at the utility tie within user-defined set points. The POWERMAX AGC system can dynamically recalculate control set points under all system bus configurations and respond to load-shedding events within a few milliseconds.

Automatic MVAR and Voltage Control System maintains MVAR flows on interties and system bus voltages by controlling load tap-changers, generator-field and large synchronous motor exciters, synchronous and static condensers, and capacitor banks, to maintain system bus voltages and MVAR flows on interties.

Automatic System Islanding Detection continuously monitors intertie points to determine if the power system has been islanded from one or more utility connections. SEL's islanding control system operates a selected generator in 'isynchronous' mode to maintain frequency control during islanding events.

Automatic Decoupling System can quickly disconnect the power system from an unstable utility source and create a system island.

System Frequency Control automatically changes operational configuration to regulate system frequency upon detection of an islanded condition. The system's advanced algorithm adjusts set points within prescribed control modes for each generator.

Automatic Load Shedding compares generator and load data with predetermined load-shedding priorities to deliver fast, contingency-based load-shedding commands within a single power cycle.

Automatic Load-Restoration will automatically close utility tie point breakers and resume real and reactive power flows once proper operating conditions are validated. This is coordinated through the generation control system to ensure all safety conditions are satisfied.

Synchronized Phasor Measurements (synchrophasors) enable a POWERMAX system to monitor and control with unprecedented accuracy and speed. SEL's modal analysis tools continuously calculate resonance and oscillation frequencies to optimize generator protection schemes.

POWERMAX Communications employ IEC 61850 GOOSE messaging or SEL MIRRORED BITS® communications technology to transmit critical control commands every power cycle. POWERMAX can also provide a secure communications platform for standard protocols such as Modbus®, DNP3, and others.

Custom Panels

SEL panel and system manufacturing adheres to strict quality controls for design, manufacturing, testing, and commissioning.

GSA Schedule
Contract: GS-07F-0123N

This SEL product is GSA approved. Contact your sales representative for pricing and delivery options.

Description

SEL designs, manufactures, tests, and delivers custom protection, control, and metering panels as well as control cabinets and retrofit doors. SEL panels are supported by an unmatched warranty and extraordinary customer service. Panels, cabinets, and doors are built to match customer specifications and needs.

SEL tests the final implementation of every manufactured system before shipping, reducing overall project costs and engineering time. SEL's testing contributes to easier and faster commissioning.

Complete Panel Solutions

- ☑ **Consulting and Engineering Design**
- ☑ **Panel Manufacturing and Testing**
- ☑ **Protection, Automation, and Control Equipment Manufacturing**
- ☑ **Field Service**

SEL SCHWEITZER ENGINEERING LABORATORIES, INC.

POWERCORE™ Substation Control System

Control enclosure deployed directly to site.

SEL POWERCORE includes all design, assembly, wiring, and testing for utility and industrial applications.

This SEL product is GSA approved. Contact your sales representative for pricing and delivery options.

Key Features

Reduced Total Ownership Costs

- Integrated engineering design.
- Efficient implementation using existing and new technology.
- Consistent operator interface.
- Reduced maintenance.
- Migration path to new technologies.

Simplified Panels

SEL multifunction protective relays minimize the number of devices and simplify wiring.

Improved System Reliability

The use of SEL protection, monitoring, and communications equipment coupled with equipment diagnostics information improves system reliability and enables condition-based control of substation equipment.

Prewired and Factory-Tested

Reduce field wiring and commissioning time and expense. A substation simulator tests protection and automation functions; wiring is complete and tested to the terminal blocks in the yard termination cabinet.

Adaptable Design

SEL can accommodate customer preferences for equipment and design details, such as substation control enclosure layout, battery system, protective relays, panel layout and wiring practices, and communications equipment.

On-Site Delivery and Offloading

The substation control enclosure is delivered directly to the job site or warehouse. SEL can arrange offloading by crane.

Customer-Specific HMI

Flexible HMI design allows for quick integration of controls and displays of analog data, status, and alarms. Optional functionality can include tagging, online documentation, historical trended data, and much more.

POWERCORE Options

- 8' x 19' Concrete
- 10' x 28' Concrete
- 8' x 19' Steel
- 3' x 24' POWERCORE-M
- 10' x 28' Steel
- 8' x 20' ISO
- 8' x 40' ISO

SEL also designs and builds custom control enclosures.

Customer design preferences easily accomplished with flexible panel layouts.
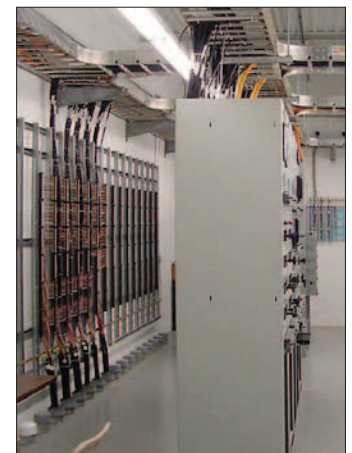
Prewired and factory tested termination cabinet for quick commissioning.

Automation and Integration Overview

Today, SEL offers technologies, products, systems, and services that address the entire application spectrum, from communicating with a single relay to integrating and automating the metering, control, reporting, and protection for a large system. In electrical substations, commercial sites, and generating, manufacturing, and processing plants, apply SEL microprocessor-based relays to protect the electrical system. Apply SEL networking, control, and communications solutions to integrate devices for data acquisition plus remote and local control.

SEL relays, information processors, and systems support many architectures. SEL information processors include real-time automation controllers (RTACs), communications processors, and tough computers with appropriate software.

Controllers and input/output (I/O) solutions include the SEL-2411 and SEL-2440 Controllers and the SEL-2240 Modular Control Network, appropriate for a variety of control and I/O mix requirements.

To communicate with serial port devices, we recommend using our information processors as the hubs of star networks, with a point-to-point fiber or copper connection between the hub and each device. Fiber-optic links provide superior noise immunity and safety. Star topologies allow each device to communicate at a different bit rate and with a different command set or protocol. This independence, coupled with the strong parsing and command capabilities of SEL information processors, enables communication with many devices.

Many modern devices communicate via an Ethernet network. Build your Ethernet local-area network (LAN) with SEL-2725 Five-Port Ethernet Switches, SEL shielded Ethernet cables, and SEL fiber-optic cables. SEL-3610 Port Servers connect Ethernet networks to serial devices.

Choose tough SEL computing and networking products that are far more reliable and robust than office or industrial computer equipment and ideal for protocol conversion, local human-machine interfaces, event report collection, data concentration, and more.

Many SEL relays include local, remote, and latched control switches and display points. With these features, you can replace or eliminate many external devices and associated panels, documentation, wiring, commissioning, testing, and maintenance. You benefit from reduced total cost, improved system reliability, and state-of-the-art protection, monitoring, and control.

The SEL-2100 Logic Processor and SEL-3530 or SEL-3530-4 RTAC can economically and simply provide bus and three-terminal line protection as well as automated control by connecting to multiple SEL relays using MIRRORED BITS® communications links. They operate on the MIRRORED BITS data through control logic and automatically send the proper trip and other control signals. SEL-2505 and SEL-2506 Remote I/O Modules connect to devices without MIRRORED BITS communications ports.

Information processors support external communications links, including the public switched telephone network for engineering access or dial-out alerts, private line connections to your SCADA system, and wide-area networks (WANs). Many SEL relays and controllers have integral protocols and ports for connection to networks. The SEL ICON™ provides the fiber-optic communications backbone.

SEL products and services are components of complete SEL solutions for instrumentation, protection, reporting, monitoring, local and remote control, and automation.
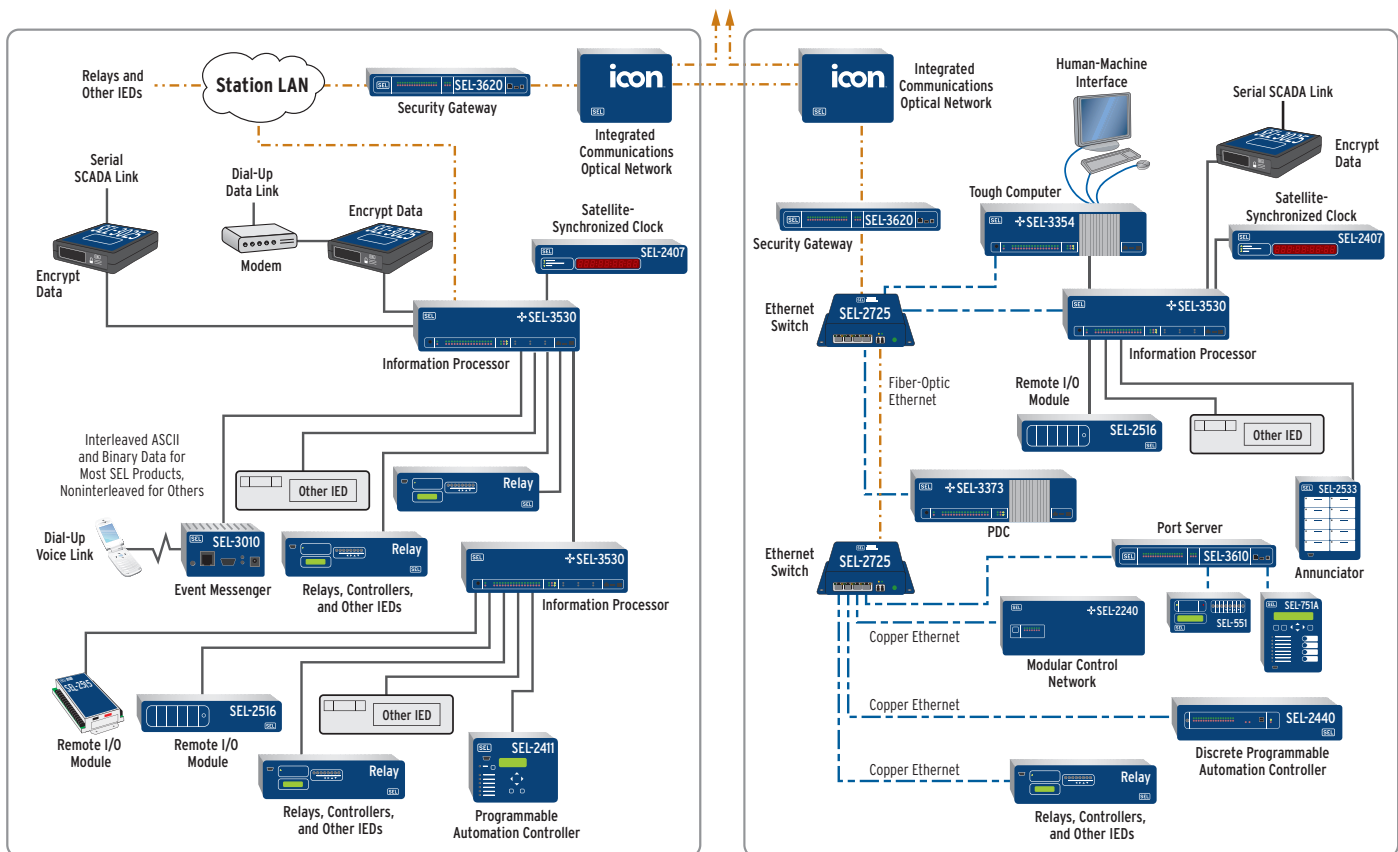
SEL Safety

Improve Safety by Applying SEL Technology

Significantly improve safety, prevent injuries, and reduce liability exposure by applying SEL products and services. Do more with remote communication to avoid entering hazardous areas, controlling traffic, and suiting up in special protective clothing.

- Reduce the energy of arc-flash hazards by installing SEL-751A Feeder Protection Relays with arc-flash detectors.
- Use SEL-3022 Wireless Encrypting Transceivers with your wireless laptop PC to remotely access systems, controllers, or relays.
- Apply the RadioRANGER® Wireless Fault Indication System to reduce the need to enter underground vaults.
- Use I/O points on your relays, programmable automation controllers, and I/O modules to sense and calculate information that system or plant operators can use to help prevent accidents. Connect to devices that detect flammable or other unsafe gases, arc flashes, water levels in underground vaults, and more.
- Monitor the status of relay alarm contacts or other relay diagnostic data, and notify operators of safety hazards caused by having protection out of service.
- Detect and trip arcing downed conductors with SEL Arc Sense™ technology (AST) in the SEL-451 Protection, Automation, and Bay Control System.
- Use SEL eye-safe, Class 1 fiber-optic communications to prevent the instrumentation and control system from introducing hazards and to reduce costs.
- Work with SEL engineers for studies to identify and categorize arc-flash hazards and determine options to reduce injuries due to arc flashes.
- Apply reliable SEL components to minimize the time service personnel spend traveling and working in hazardous locations.
- Communicate directly with personnel using portable electronics and remote warning indicators, including SEL annunciation products, at the entrance to hazardous locations. Apply the SEL-3010 Event Messenger to call appropriate personnel.

Overcurrent protection and arc-flash light sensing work together in the SEL-751A to mitigate false trips.

Mitigate Arc-Flash Hazards With SEL Solutions

Improve Safety

Arc-flash detection decreases fault-clearing time, which reduces arc-flash hazards, improves safety, and lowers personal protective equipment (PPE) requirements.

Reduce Arc-Flash Hazard in Any Switchgear

SEL's cost-effective arc-flash mitigation technology reduces arc-flash-related equipment damage in both standard and arc-resistant switchgear.

Maximize Power System Uptime

Arc-flash mitigation minimizes equipment damage during an arc-flash event. Returning affected equipment to service faster maximizes power system availability.

Simplify Procedures

Arc-flash detection is always enabled. An operator doesn't have to modify protective settings before and after performing live work to be protected from arc-flash events.

### Maintain Selective Coordination

Arc-flash events trigger an immediate response while coordination is maintained with downstream protection for external faults.

Substantial reductions in arc-flash hazards and Hazard/Risk Category (HRC) levels are achievable with SEL's arc-flash detection and mitigation solutions.
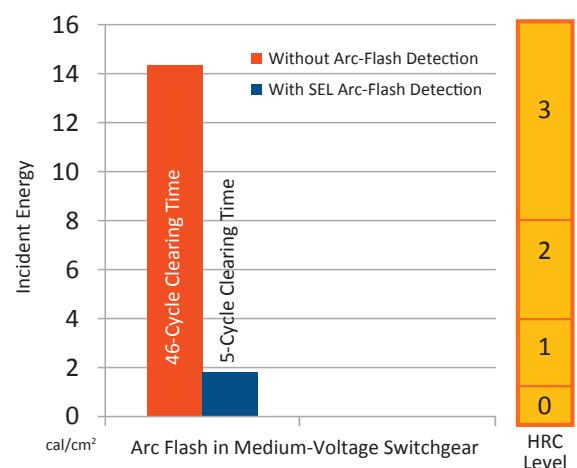
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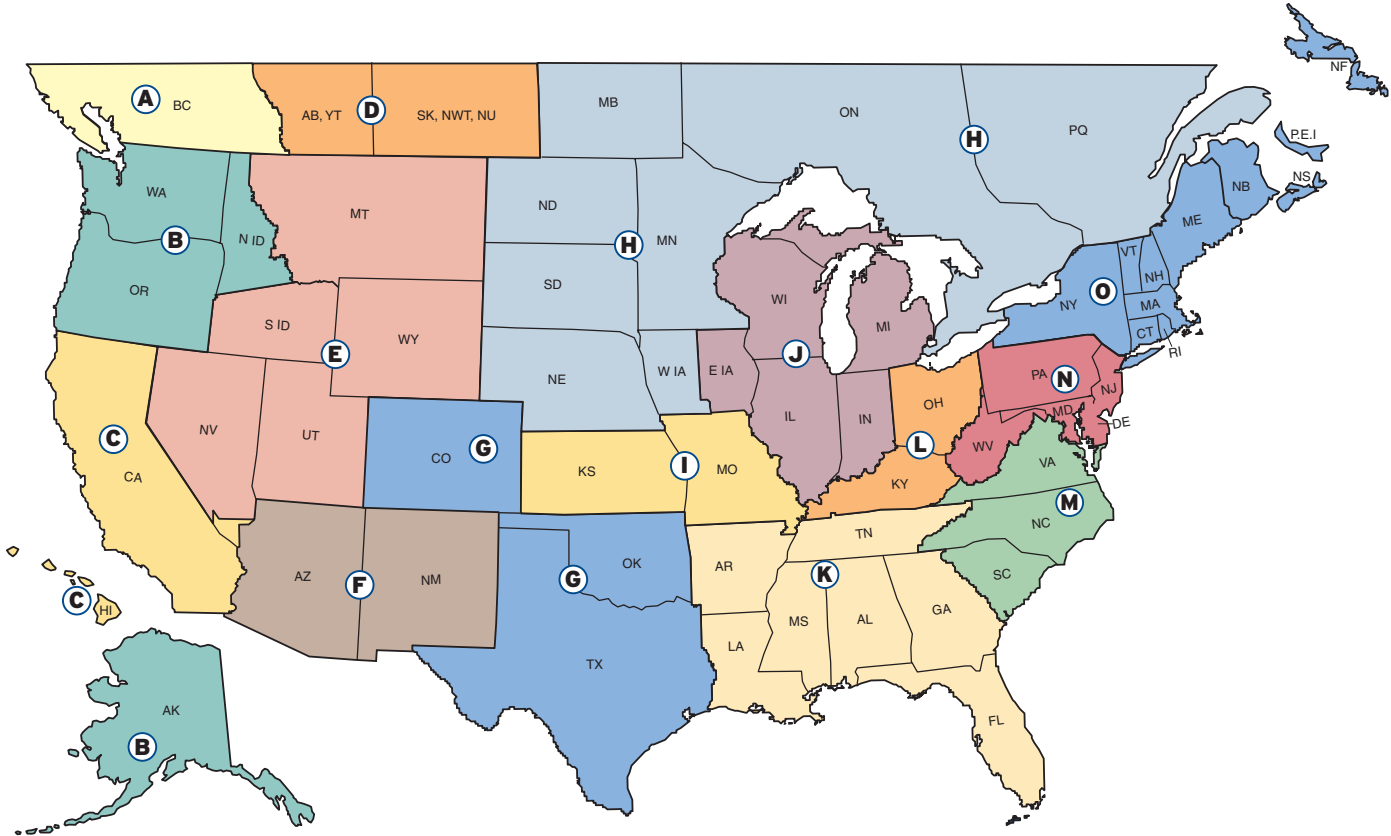
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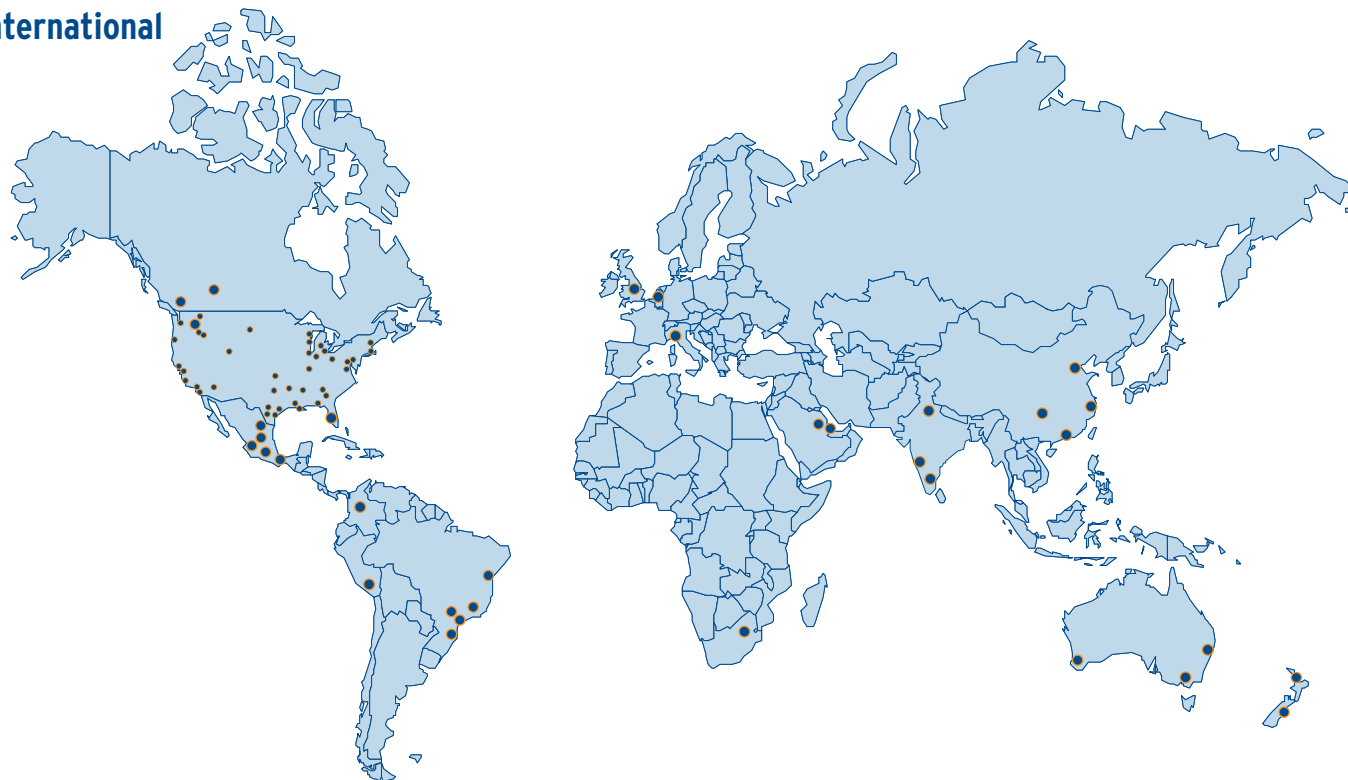www.atlanticpowersales.com

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