



## PRODUCT AND SOLUTION GUIDE





### Ultra-High-Speed Protection

Meet the SEL-T401L Ultra-High-Speed Line Relay, which combines time-domain technologies and high-performance distance elements for a complete protection and monitoring system.



### Capacitor Bank Control

Enhance your distribution system using the new SEL-734W Capacitor Bank Control with wireless current sensors to improve power quality.



### Advanced Generator Protection

Provide advanced generator, bus, transformer, and auxiliary system protection for hydro, thermal, and pumped-storage applications with the new SEL-400G.



### Fault Transmitter and Receiver

Apply the SEL-FT50 and SEL-FR12 Fault Transmitter and Receiver System to enhance distribution substation protection and improve the reliability and safety of your feeder.



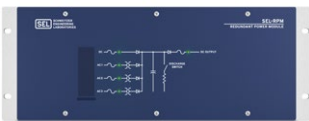
### Synchrowave® Operations Software

Increase grid safety and reliability with situational awareness of power system operations.



### Time-Domain Link (TiDL®) Technology

Convert data using a TiDL merging unit and transport them via fiber to as many as four relays to achieve a simple, secure digital secondary system solution.



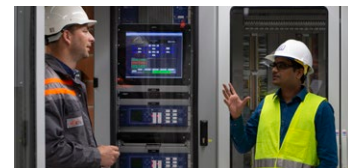
### Redundant Power Module

Combine multiple ac and dc power sources with the new SEL-RPM Redundant Power Module to increase control power availability and reliability.



### Software-Defined Networking

Improve local-area networking with deny-by-default cybersecurity and fast failover.



### POWERMAX® Power Management

Intelligent control for seamless islanding as well as comprehensive generation and load management solutions.

## On the Cover

The Tohono O'odham Utility Authority (TOUA) became the world's first subtransmission utility to experience the SEL-T400L relay's unprecedented tripping speed. In just over half an hour, the relay tripped seven times—in under 2 ms each time.

Read the story of how TOUA made electric transmission protection history at [selinc.com/featured-stories/TOUA](http://selinc.com/featured-stories/TOUA).

"If not for this new technology, the power would have gone out and our crews would have been driving around and trying to restore it in bad weather. Instead, it did the job so well that we didn't even know about the disturbance until later."

—Darrold Hobbs, TOUA Electric Department Operations Manager



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## 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.

SEL teams offer services, education, and support for a variety of industries and throughout the power system. Our Engineering Services team provides engineering expertise and system solutions to customers worldwide. SEL University offers training that helps our customers meet the technical challenges of integrating digital technologies into their expanding power system infrastructure.

### Our history

Edmund O. Schweitzer, III, founded SEL in 1982 in Pullman, Washington. SEL introduced the world's first digital protective relay to the electric power industry in 1984. The SEL-21 revolutionized the power protection industry by providing fault locating and real fault data at a much lower cost than traditional electromechanical relays. In 2016, we set the standard for technology with the introduction of the world's fastest transmission line relay, the SEL-T400L Time-Domain Line Protection. And today we've introduced the SEL-T401L Ultra-High-Speed Line Relay that merges time-domain technology with phasor-based protection in a single device.

As part of a long-term strategy for sustained growth, stability, and customer focus, SEL became an employee-owned company in 1994 and transitioned to 100 percent employee ownership in 2009. Our ownership value is at the heart of our employees' hard work to reduce costs, increase quality, and create the superior products that enable us to fulfill our mission.



1984  
SEL-21



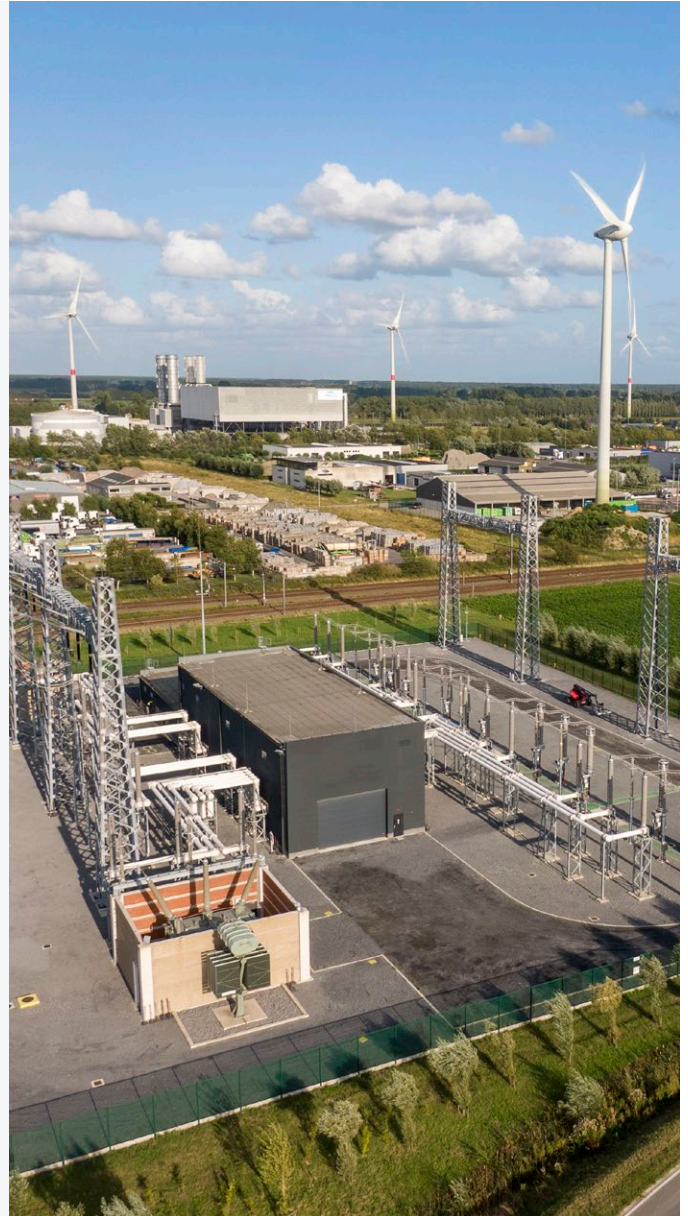
Today  
SEL-T401L



## Industries we serve

From the beginning, we've provided solutions for electric utilities. As our company has grown, so have our product portfolio and the number of industries we serve. From airports and hospitals to the power grids of entire countries, SEL solutions are protecting and controlling critical operations around the world.

- 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





## Engineering is our middle name

At SEL, we are passionate about our work, knowing it contributes directly to improving the reliability of electric power, keeping people safe, and helping customers conserve resources through efficiency, simplicity, and creativity.

We develop innovative products and services by focusing on the challenges our customers face. This helps us create the best solutions for a wide range of industries and applications. Every day, SEL engineers create new technologies and solutions to solve our industry's challenges.

## Our commitment to quality

Because SEL equipment becomes part of critical—and complex—infrastructure, from the electric power grid to processing and manufacturing facilities, we focus on long-term reliability and quality.

We warranty our products for 10 years and design them to last more than 20 years, and after serving our customers for more than 30 years, we still don't charge for repairs—regardless of the age of the product. Our free repair policy generates useful data that we use to drive product and service improvements. Constant improvement is an integral part of quality at SEL because of the lives and critical infrastructure our products protect.



"As engineers, 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  
Chief Executive Officer



### Service and support you can count on

We understand the importance of local support, which is why we have application engineers, customer service representatives, and sales managers in over 100 offices worldwide. Our network of independent sales representatives and distributors provides additional sales support in many regions. This network of local experts supports SEL products and solutions in 165 countries, ensuring the best possible user experience.

SEL's outstanding customer service and support reflect who we are. Our commitment to serving our industry is consistent with our values and ethics. We believe strongly in our core company values, which are not only an essential part of our working environment but also the way we view our community, industry, and the natural environment.



"Society depends upon safe, reliable, and economical electric power. At SEL, we take our responsibility to this industry seriously. We strive to exceed expectations with extraordinary customer service, with expert application engineers who are always available to provide technical support close to our customers, and with sales engineers who solve problems by teaching and by adding value with SEL technology and innovation."

—David Costello  
Chief Sales & Services Officer

# Example Product Applications

## Generators



Comprehensive Generator Protection  
(SEL-400G, SEL-700G)



Resistance Temperature Detection  
(SEL-2600)



Ground Fault Protection  
(SEL-2664, SEL-2664S)

## Transmission Lines



Time-Domain Line Protection  
(SEL-T400L, SEL-T401L)



Traveling-Wave Fault Location  
(SEL-T400L, SEL-T401L, SEL-411L)



Subcycle Line Differential Protection  
(SEL-311L, SEL-411L)



Subcycle Distance Protection  
(SEL-421, SEL-311C)



Merging Unit With Built-In Distance  
Protection (SEL-421)

## Distribution Feeders



Distribution Protection  
(SEL-351, SEL-351A, SEL-351S, SEL-851)



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



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



Voltage Regulator Control  
(SEL-2431)



Capacitor Bank Control  
(SEL-734B, SEL-734W and SEL-8340)



Fault Transmitter and Receiver System  
(SEL-FT50 and SEL-FR12)

## Distributed Generation (DG)



Intertie/Wind Generator Protection  
(SEL-700GT, SEL-700GW)



DG Interconnection Recloser Control  
(SEL-651R, SEL-651RA)

## Power Transformers



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



Four-Winding Transformer Differential  
Protection (SEL-387)



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



Two-, Three-, and Four-Winding  
Transformer Differential and Voltage  
Protection (SEL-787, SEL-787-2/-3/-4)



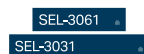
Transformer Monitoring  
(SEL-2414)



Overhead and Underground Fault  
Indication (SEL-AR360, SEL-AR, SEL-ARU,  
SEL-TPR, SEL-CR)



Recloser Control (SEL-651R, SEL-651RA,  
SEL-351RS Kestrel®)



Encrypted Wireless Communication  
(SEL-3031, SEL-3061)



Compact Satellite-Synchronized  
Precise Time (SEL-2401)



Real-Time Automation Control  
(SEL-3505)




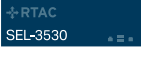


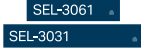






Wireless Fault Detection and Load  
Monitoring (SEL-FLT and SEL-FLR,  
SEL-8301)






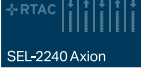


## Substations

|   |   |
|---|---|
|    | Satellite-Synchronized Precise Time (SEL-2401, SEL-2404, SEL-2407®, SEL-2488, SEL-3401)                         |
|    | Protection, Automation, and Bay Control (SEL-451)   |
|    | Low-Impedance Bus Differential Protection (SEL-487B)  |
|    | Capacitor Protection and Control (SEL-487V)   |
|    | High-Impedance Differential Protection (SEL-587Z)   |
|    | Power Quality and Revenue Metering (SEL-735)  |
|    | Programmable Automation Control (SEL-2411, SEL-2440)  |
|   | Annunciation and Notification (SEL-2522, SEL-2523, SEL-2533)  |
|  | Merging Units With Built-In Protection (SEL-401, SEL-421)   |
|  | Digital Secondary System Protection and Control (TiDL®, SEL-TMU, SEL-401, SEL-421, SEL-451, SEL-487B, SEL-487E) |

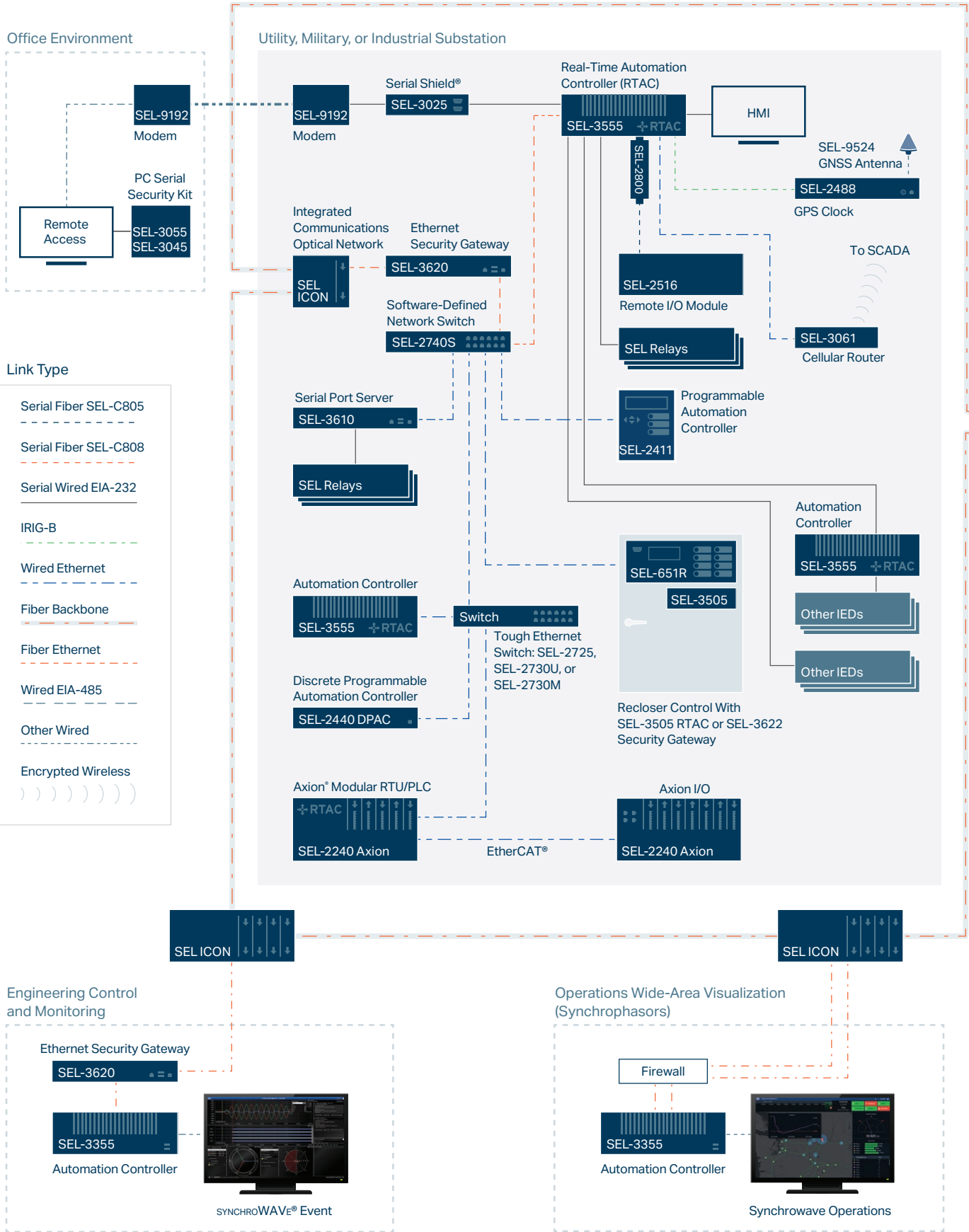
|  |   |
|--|---|
|    | Rugged Computing (SEL-3350, SEL-3355, SEL-3360)                                     |
|    | Wide-Area Communications (SEL-ICON®)  |
|    | Modular I/O and Real-Time Automation Control (SEL-2240 Axion®)                      |
|    | Real-Time Automation Control (SEL-3530/3530-4, SEL-3555, SEL-3505/3505-3, SEL-3560) |
|    | Cybersecurity (SEL-3620, SEL-3622)  |
|    | Rugged Ethernet Networking (SEL-2730M, SEL-2730U, SEL-2725, SEL-2740S)              |
|    | Encrypted Wireless Communication (SEL-3031, SEL-3061)                               |
|    | Bluetooth® Serial Communication (SEL-2924, SEL-2925)                                |
|  | High-Speed Remote I/O (SEL-2507)  |
|   | Fiber-Optic Communication (Fiber-Optic Transceivers)                                |
|  | Control Power Source Diversity (SEL-RPM)  |

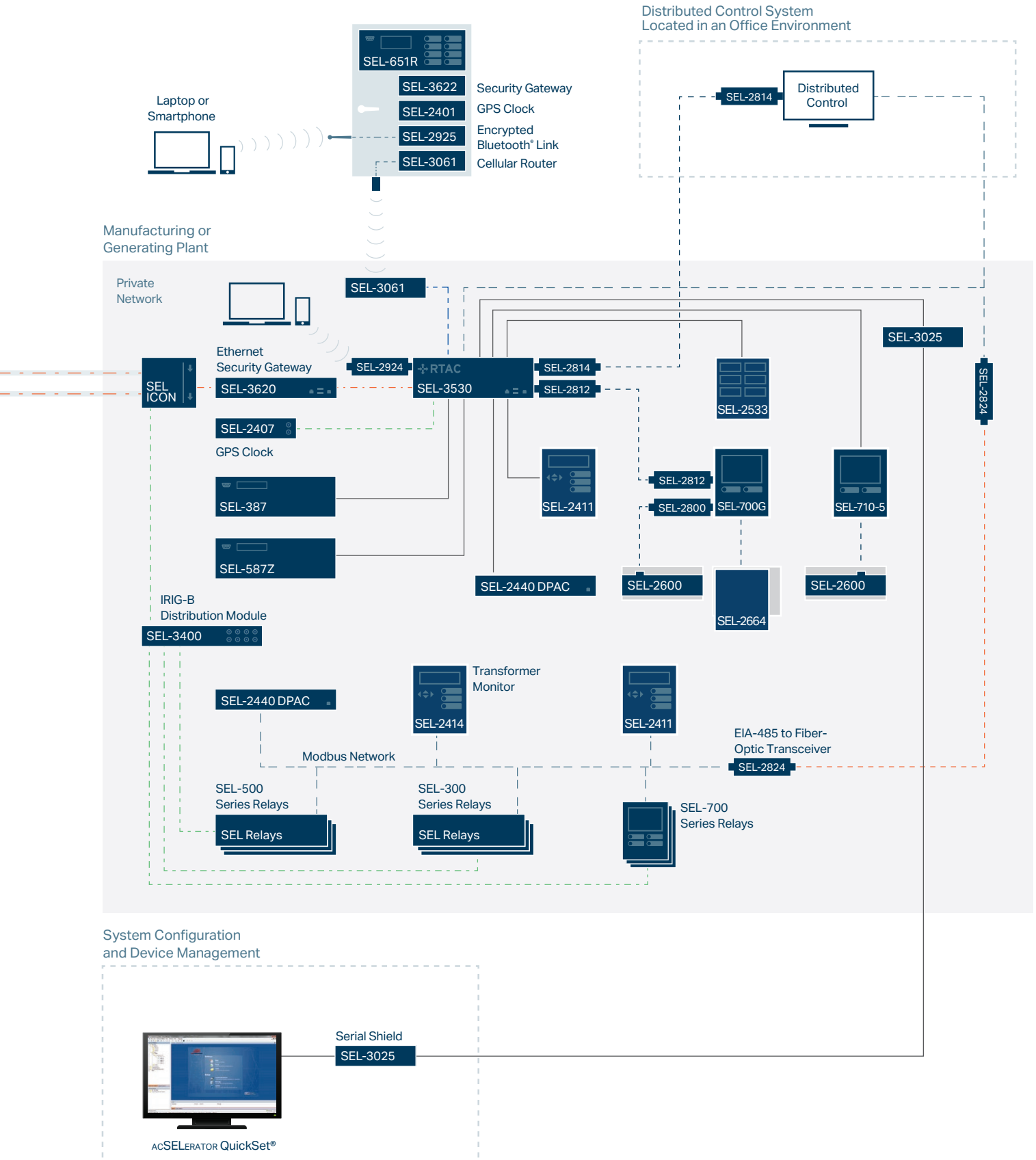
## Industrial/Commercial

|   |   |
|---|---|
|  | Motor Protection (SEL-710-5, SEL-849, MOTORMAX®)                |
|  | Power Quality and Revenue Metering (SEL-735)                    |
|  | Annunciation and Notification (SEL-2522, SEL-2523, SEL-2533)    |
|  | Programmable Automation Control (SEL-2411, SEL-2411P, SEL-2440) |
|  | Feeder Protection With Arc-Flash Detection (SEL-751)            |

|  |  |
|--|--|
|   | Rugged Ethernet Networking (SEL-2740S, SEL-2742S)                  |
|   | Fast Motor Bus Transfer (SEL-700BT, SEL-451)                       |
|  | Industrial Automation and Computing (SEL-3350, SEL-3355, SEL-3360) |
|  | Modular I/O and Real-Time Automation Control (SEL-2240 Axion)      |
|  | Cybersecurity (SEL-3620, SEL-3622)                                 |
|   | Wireless Communications (SEL-3061)                                 |

## Example Network Communications Diagram









# Generator and Motor Protection



## SEL-400G **NEW**

Provide unsurpassed protection, integration, control, and monitoring features for all types of generators, including hydropower, pumped-storage hydropower, large steam turbines, and combustion gas turbines.



## SEL-700G

Provide utility and industrial generator protection with an autosynchronizer, flexible I/O, and advanced communications.



## SEL-300G

Implement comprehensive primary and backup generator protection for large and small machines.



## SEL-2664S

Protect high-impedance grounded generators from ground faults at standstill, during startup, and while running.



## SEL-2664

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



## SEL-2600

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



## SEL-700BT **NEW**

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

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



## SEL-849

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

| Applications                              | SEL-400G | SEL-700G | SEL-700GT | SEL-700GW | SEL-300G | SEL-700BT | SEL-710-5 | SEL-849 |
|---|----------|----------|-----------|-----------|----------|-----------|-----------|---------|
| Generator Protection                      | ■        | ■        | +         |           | ■        | ■         |           |         |
| Induction Motor Protection                |          |          |           |           |          |           | ■         | ■       |
| Synchronous Motor Protection              |          |          |           |           |          |           | +         |         |
| Motor Bus Transfer Protection             |          |          |           |           |          | ■         |           |         |
| Feeder Protection                         |          |          |           | ■         |          |           |           | ■       |
| Breaker Failure Protection                | ■        | ■        | ■         |           | <i>f</i> | ■         | ■         | ■       |
| Equipment Thermal Monitoring              | ■        | ■        | +         | +         | +        | ■         | +         | ■       |
| Generator Intertie Protection             |          |          | ■         |           |          |           |           |         |
| Synchronism Check                         | ■        | +        | ■         |           | +        | ■         |           |         |
| Integrated Synchronizer                   | +        | +        | +         |           |          | ■         |           |         |
| <b>Instrumentation and Control</b>        |          |          |           |           |          |           |           |         |
| Breaker Wear Monitor                      | ■        | ■        | ■         | ■         | ■        | ■         | ■         |         |
| Demand Meter                              | ■        | ■        | ■         | ■         | ■        | ■         | ■         | ■       |
| Load Profile Report                       | ■        | ■        | ■         | ■         |          | ■         | ■         | ■       |
| RTD Inputs                                | ■        | +        | +         | +         | +        | +         | +         |         |
| Ethernet                                  | +        | +        | +         | +         |          | +         | +         | ■       |
| IEC 61850 Edition 2                       | +        | +        | +         | +         |          | +         | +         | +       |
| IEC 60870-5-103                           |          | +        | +         | +         |          | +         | +         |         |
| 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                     |          | ■        | ■         | ■         | +        | ■         | ■         | ■       |
| Synchrophasors With IEEE C37.118 Protocol | ■        | ■        | ■         | ■         |          |           |           |         |
| MIRRORED BITS® Communications             | ■        | ■        | ■         | ■         |          | ■         | ■         |         |

| Protection   | SEL-400G | SEL-700G | SEL-700GT | SEL-700GW | SEL-300G | SEL-700BT | SEL-710-5 | SEL-849 |
|--|----------|----------|-----------|-----------|----------|-----------|-----------|---------|
| 21P Phase Mho or Compensator Distance                        | ■        | +        |           |           | ■        |           |           |         |
| 24 Overexcitation (Volts/Hertz)                              | ■        | ■        | +         |           | ■        |           |           |         |
| 27/59 Under-/Overvoltage                                     | ■        | ■        | ■         |           | ■        | ■         | ■         | +       |
| 27I/59I Inverse-Time Under-/Overvoltage                      | ■        | ■        | ■         |           |          | ■         | ■         |         |
| 32 Directional Power   | ■        | ■        | ■         |           | ■        |           |           | +       |
| 37 Underpower  |          |          |           |           |          |           | ■         | +       |
| 40 Loss of Field   | ■        | ■        | +         |           | ■        |           |           |         |
| 46 Current Unbalance   | ■        | ■        | +         |           | ■        | ■         | ■         | ■       |
| 47 Phase Reversal  |          |          |           |           |          |           | ■         | ■       |
| 49 Thermal   | ■        | ■        | +         |           |          |           | ■         | ■       |
| 49R Thermal Overload (Resistance Temperature Detector [RTD]) | ■        | ■        | ■         | ■         | ■        | ■         | +         |         |
| 50 (P,N,Q) Overcurrent (Phase, Neutral, Negative Sequence)   | ■        | ■        | ■         | ■         | ■        | ■         | ■         | ■       |
| 50Q Negative-Sequence Overcurrent                            |          | ■        | ■         | ■         | ■        | ■         | ■         | ■       |
| 51 (N,G) Time Overcurrent (Neutral, Ground)                  | ■        | ■        | ■         | ■         | ■        | ■         | ■         | ■       |
| 51 (P,Q) Time Overcurrent (Phase, Negative Sequence)         | ■        |          | ■         | ■         |          | ■         | ■         | ■       |
| 55 Power Factor  |          | <i>f</i> | <i>f</i>  |           | <i>f</i> |           | ■         | +       |
| 60 Loss of Potential   | ■        | ■        | ■         |           | ■        | ■         | ■         | +       |
| 64G 100 Percent Stator Ground                                | ■        | +        |           |           | ■        |           |           |         |
| 64F Field Ground   | ■        | ■        | +         |           | ■        |           |           |         |
| 67 (N,G) Directional Overcurrent (Neutral, Ground)           | ■        | ■        | ■         |           |          | ■         |           |         |
| 78 Out of Step   | ■        | +        |           |           | ■        |           | ■         |         |
| 81 Over-/Underfrequency                                      | ■        | ■        | ■         |           | ■        | ■         | ■         | +       |
| 87 Current Differential                                      | ■        | +        |           |           | +        |           | +         |         |
| REF Restricted Earth Fault                                   | ■        | ■        | +         |           |          |           |           |         |
| Arc-Flash Detection  |          |          |           |           |          |           | +         | ■       |
| Separate Neutral Overcurrent                                 | ■        | ■        | ■         |           | ■        | ■         | ■         | ■       |
| Broken Rotor Bar Detection                                   |          |          |           |           |          |           | ■         |         |

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



# Transmission Protection



## SEL-T400L

Apply the SEL-T400L for ultra-high-speed protection of transmission lines. With breakthrough time-domain technologies, the SEL-T400L trips in as fast as 1 ms, records events with a 1 MHz sampling rate, and locates faults to the nearest tower.



## SEL-T401L **NEW**

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. Use the SEL-T401L as a redundant protection system with other SEL relays without concerns for common-mode failures.



## SEL-T4287

Test traveling-wave fault locators and line protective relays using the SEL-T4287, a simple-to-use, compact, and economical secondary pulse injection test set.



## SEL-421

Employ the SEL-421 for high-speed distance and directional protection and complete control of a two-breaker bay.



## SEL-411L

Apply the SEL-411L for subcycle single- or three-pole line current differential, distance, and directional overcurrent protection. Traveling-wave fault locating pinpoints faults to the nearest tower span.



## SEL-311C

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



## SEL-311L

Use the SEL-311L with four-zone distance backup for easy-to-apply, high-speed line protection.



## SEL-387L

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



| Applications               | SEL-T400L | SEL-T401L | SEL-411L | SEL-421 | SEL-311C | SEL-311L | SEL-387L |
|----------------------------|-----------|-----------|----------|---------|----------|----------|----------|
| Distance Protection        | ■         | ■         | ■        | ■       | ■        | ■        |          |
| Line Current Differential  |           |           | ■        |         |          | ■        | ■        |
| Traveling-Wave Protection  | ■         | ■         |          |         |          |          |          |
| Breaker Failure Protection |           |           | ■        | ■       | ■        | f        |          |
| Undervoltage Load Shedding |           | f         | f        | f       | f        | f        |          |
| Series-Compensated Lines   | ■         | ■         | +        | +       |          |          |          |

## Protection

|   |   |   |   |   |   |   |   |
|---|---|---|---|---|---|---|---|
| 21 (G,P,XG,XP) Distance (Mho Ground, Mho Phase, Quad Ground, Quad Phase)  |   | ■ | ■ | ■ | ■ | ■ |   |
| 25 Synchronism Check  |   |   | ■ | ■ | ■ | ■ |   |
| 27/59 Under-/Overvoltage  |   | ■ | ■ | ■ | ■ | ■ |   |
| 32 Directional Power  |   |   | ■ | ■ |   |   |   |
| 49 Thermal  |   |   | f | f |   |   |   |
| 50 (N,G,P,Q) Overcurrent (Neutral, Ground, Phase, Negative Sequence)      |   | ■ | ■ | ■ | ■ | ■ |   |
| 51 (N,G,P,Q) Time Overcurrent (Neutral, Ground, Phase, Negative Sequence) |   | ■ | ■ | ■ | ■ | ■ |   |
| 67 (N,G,P,Q) Directional Overcurrent (Neutral, Ground, Phase, Neg. Seq.)  |   | ■ | ■ | ■ | ■ | ■ |   |
| 81 Under-/Overfrequency   |   |   | ■ | ■ | ■ | ■ |   |
| 87L Line Current Differential   |   |   | ■ |   |   | ■ | ■ |
| Programmable Analog Math  |   |   | ■ | ■ |   |   |   |
| Out-of-Step Block and Trip  |   | ■ | ■ | ■ | ■ | ■ |   |
| Load Encroachment Supervision   |   | ■ | ■ | ■ | ■ | ■ |   |
| Switch-Onto-Fault   |   | ■ | ■ | ■ | ■ | ■ |   |
| Single-Pole Trip  | ■ | ■ | ■ | ■ | + | + |   |
| TD21 Incremental-Quantity Distance  | ■ | ■ |   |   |   |   |   |
| TD32 Incremental-Quantity Directional                                     | ■ | ■ |   |   |   |   |   |
| TW32 Traveling-Wave Directional   | ■ | ■ |   |   |   |   |   |
| TW87 Traveling-Wave Differential  | ■ | ■ |   |   |   |   |   |
| Zone/Level Timers   |   | ■ | ■ | ■ | ■ | ■ |   |
| Pilot Protection Logic  | ■ | ■ | ■ | ■ | ■ | ■ |   |

| Instrumentation and Control                                   | SEL-T400L | SEL-T401L | SEL-411L | SEL-421 | SEL-311C | SEL-311L | SEL-387L |
|---|-----------|-----------|----------|---------|----------|----------|----------|
| 79 Automatic Reclosing  |           |           | ■        | ■       | ■        | ■        |          |
| Number of Controlled Breakers/CT Inputs                       | 2         | 2         | 2        | 2       | 1        | 1        | 1        |
| Fault Locating  | ■         | ■         | ■        | ■       | ■        | ■        |          |
| Traveling-Wave Fault Locating                                 | ■         | ■         | +        |         |          |          |          |
| Subcycle Distance Elements                                    |           | ■         | +        | +       | +        |          |          |
| SELogic® Control Equations                                    |           | ■         | ■        | ■       | ■        | ■        |          |
| Nonvolatile Latch Control Switches                            |           | ■         | ■        | ■       | ■        | ■        |          |
| SELogic Remote and Local Control Switches                     |           | ■         | ■        | ■       | ■        | ■        |          |
| Display Points  |           |           | ■        | ■       | +        | ■        |          |
| MIRRORED BITS® Communications                                 | ■         | ■         | ■        | ■       | ■        | ■        |          |
| Substation Battery Monitor                                    |           |           | ■        | ■       | ■        | ■        | ■        |
| Breaker Wear Monitor  |           |           | ■        | ■       | ■        | ■        |          |
| Trip Coil Monitor   |           |           | f        | f       | f        | f        |          |
| Event Report (Multicycle Data) and Sequential Events Recorder | ■         | ■         | ■        | ■       | ■        | ■        | ■        |
| 1 MHz Event Reports   | ■         | ■         |          |         |          |          |          |
| Instantaneous Metering  | ■         | ■         | ■        | ■       | ■        | ■        | ■        |
| Software-Invertible Polarities                                |           |           | ■        | ■       |          |          |          |
| IEC 60255-Compliant Thermal Model                             |           |           | ■        | ■       |          |          |          |
| DNP3 Level 2 Outstation                                       | ■         | ■         | ■        | ■       | ■        | +        | +        |
| Parallel Redundancy Protocol (PRP)                            |           |           | ■        | ■       | ■        |          |          |
| IEEE 1588 Precision Time Protocol Version 2 (PTPv2)           |           |           | +        | +       |          |          |          |
| IEEE C37.94 Protocol  |           | ■         | +        |         |          | +        |          |
| IEC 61850-9-2 Sampled Values Technology                       |           |           |          | +       |          |          |          |
| Time-Domain Link (TiDL®) Technology                           |           |           |          | +       |          |          |          |
| IEC 61850 Communications                                      |           |           | +        | +       | +        | +        |          |
| Synchrophasors  |           |           | ■        | ■       | ■        | ■        |          |
| Built-In Current and Voltage Playback Capability              | ■         | ■         |          |         |          |          |          |
| SEL Fast Time-Domain Values                                   | ■         | ■         |          |         |          |          |          |

## Miscellaneous

|   |   |   |   |   |   |  |  |
|---|---|---|---|---|---|--|--|
| Accepts Delta Voltage Transformers for Protection |   |   |   |   | + |  |  |
| Configurable Labels                               | ■ | ■ | ■ | ■ | + |  |  |

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



## Substation Protection



### SEL-787-2/-3/-4

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



### SEL-TMU **NEW**

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 TiDL relays.



### SEL-401

Apply the SEL-401 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.



### SEL-487V

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



### SEL-487E

Provide high-speed transformer differential protection for up to five terminals as well as advanced monitoring, metering, automation, and control.



### SEL-2414

Provide complete system monitoring and control for new and existing transformers.



### SEL-487B

Provide bus differential and breaker failure protection, automation, and control in applications with up to seven terminals per relay.



### SEL-587Z

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



### SEL-352

Provide breaker failure protection and breaker control and monitoring with unparalleled flexibility.

## 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  | ■        | f        | f       | f        | ■       | ■                  | ■                  | f       | f        |
| Transformer and Machine Current Differential                          | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  | ■       |          |
| Low-Impedance Bus Differential  | ■        | ■        | ■       |          |         |                    | ■                  |         |          |
| Underfrequency Load Shedding  | ■        | f        |         |          | +       | +                  | +                  |         |          |
| Undervoltage Load Shedding  | ■        | f        |         |          | +       | +                  | +                  |         |          |
| Three-Phase Current Inputs  | 5        | 3        | 4       | 2        | 2       | 2'                 | 3 or 4             | 2       | 3'       |
| Three-Phase Voltage Inputs  | 2        | 1        |         |          | 1'      | 1'                 | 1'                 |         | 1'       |
| Protection  |          |          |         |          |         |                    |                    |         |          |
| 24 Overexcitation (Volts/Hertz)                                       | ■        | ■        |         |          | +       | +                  | +                  |         |          |
| 25 Synchronism Check  | ■        |          |         |          |         |                    | +                  |         |          |
| 27/59 Under-/Overvoltage  | ■        | ■        |         |          | +       | +                  | +                  |         |          |
| 32 Directional Power  | ■        |          |         |          | +       | +                  | +                  |         |          |
| 46 Current Unbalance  | ■        |          |         |          |         |                    |                    |         |          |
| 49 Equipment Thermal Monitoring                                       | ■        |          | +       | ■        | ■       | ■                  | ■                  |         |          |
| 50FO Flashover Protection   | f        | f        |         |          | f       | f                  | f                  |         |          |
| 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                                       | f        |          |         |          |         |                    |                    |         |          |
| 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  | f        | f        |         |          | f       | f                  | f                  |         |          |
| Transformer Cooling Fan Control                                       | f        |          |         |          | f       | f                  | f                  |         | ■        |
| Nonvolatile Latch Control Switches                                    | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  |         | ■        |
| SELogic Remote Control Switches                                       | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  | ■       | ■        |
| SELogic Local Control Switches  | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  |         | ■        |
| Display Points  | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  |         | ■        |
| Multiple Settings Groups  | ■        | ■        | ■       | ■        | ■       | ■                  | ■                  |         |          |
| Substation Battery Monitor  | ■        | ■        | ■       | ■        |         | +                  | +                  |         | f        |
| 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

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



## Bus Protection

| Applications                                 | SEL-387  | SEL-487B             | SEL-487E | SEL-587Z |
|--|----------|----------------------|----------|----------|
| Breaker Failure Protection                   | <i>f</i> | ■                    | ■        | <i>f</i> |
| Bus Differential                             | <i>f</i> | ■                    | ■        | ■        |
| Transformer and Machine Current Differential | ■        |                      | ■        |          |
| High-Impedance Bus Differential              |          |                      |          | ■        |
| Low-Impedance Bus Differential               | ■        | ■                    | ■        |          |
| Three-Phase Current Inputs                   | 4        | 7/10/21 <sup>†</sup> | 5        | Common   |
| Three-Phase Voltage Inputs                   |          | 1                    | 2        |          |

### Protection

|   |   |                    |          |   |
|---|---|--------------------|----------|---|
| 27/59 Under-/Overvoltage                    |   | ■                  | ■        |   |
| 46 Current Unbalance                        |   | <i>f</i>           | ■        |   |
| 47 Voltage Unbalance                        |   |                    | <i>f</i> |   |
| 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          | 1 | 2/3/6 <sup>†</sup> | 1        | 1 |
| Check Zones                                 |   | 3                  |          |   |

| Instrumentation and Control                         | SEL-387 | SEL-487B | SEL-487E | SEL-587Z |
|---|---------|----------|----------|----------|
| 79 Automatic Reclosing                              |         | <i>f</i> | <i>f</i> |          |
| 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

|   |   |   |   |  |
|---|---|---|---|--|
| Connectorized® (Quick Disconnect) Available | + | + | + |  |
|---|---|---|---|--|

■ Standard feature    + Model option    <sup>†</sup>1/2/3 relay application

*f* 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                            |          | <i>f</i> |          | ■        |
| Underfrequency Load Shedding                               |          | <i>f</i> |          | <i>f</i> |
| Undervoltage Load Shedding                                 | <i>f</i> | <i>f</i> | <i>f</i> | <i>f</i> |
| <b>Protection</b>  |          |          |          |          |
| 25 Synchronism Check                                       | ■        | ■        |          |          |
| 27/59 Under-/Overvoltage                                   | ■        | ■        | ■        | ■        |
| 32/37 Power Elements                                       | ■        | <i>f</i> | <i>f</i> | ■        |
| 46 Current Unbalance                                       | ■        | <i>f</i> | <i>f</i> | ■        |
| 47 Voltage Unbalance                                       |          | <i>f</i> | <i>f</i> | <i>f</i> |
| 49 Equipment Thermal Monitoring                            | +        | <i>f</i> |          | <i>f</i> |
| 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                                   | ■        | <i>f</i> |          | ■        |
| Single-Pole Trip/Close                                     | ■        |          | ■        |          |

| Instrumentation and Control                           | SEL-352  | SEL-451  | SEL-487B | SEL-487V |
|---|----------|----------|----------|----------|
| Open-Pole Detection                                   |          | <i>f</i> | <i>f</i> | ■        |
| 79 Automatic Reclosing                                | <i>f</i> | ■        | <i>f</i> | <i>f</i> |
| 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

*f* May be created using relay elements and timers



# Distribution Protection



## SEL-851 **NEW**

A compact relay for utility and industrial applications that provides powerful feeder protection, monitoring, and control as well as fast and secure arc-flash detection.



## SEL-751

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

Flexible overcurrent protection with complete substation bay control.



## SEL-351

Transmission or distribution overcurrent protection, monitoring, and control.



## SEL-351A

An economical solution for distribution feeder protection.



## SEL-351S

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



## SEL-501

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



## SEL-551/551C

Distribution protection and control in new and retrofit installations.



| 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 Protection  | ■       | ■       | f        | ■        | ■       | ■           | ■           | +             | f            |
| Generator Intertie Protection   | ■       | ■       | ■        | ■        |         | +           | +           |               |              |
| Synchronism Check   | ■       | ■       | ■        | ■        |         | +           | +           |               |              |
| Underfrequency Load Shedding  | f       | ■       | ■        | ■        | ■       | ■           | ■           |               |              |
| Undervoltage Load Shedding  | f       | ■       | ■        | ■        | +       | +           | +           |               |              |
| <b>Protection</b>   |         |         |          |          |         |             |             |               |              |
| 27/59 Under-/Overvoltage  | ■       | ■       | ■        | ■        | +       | +           | +           |               |              |
| 32 Directional Power Elements   | ■       | +       |          | +        | +       | +           | +           |               |              |
| 49 IEC Line/Cable Thermal Overload  | f       |         |          |          |         | ■           |             |               |              |
| 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  | ■       | ■       |          | ■        |         |             |             |               |              |
| Rate-of-Change of Frequency (df/dt)   | ■       | ■       | ■        | ■        |         | +           | +           |               |              |
| 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      | 4/3     | 4/3<br>4/5+ | 4/0<br>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                                       | f       | f       | f        | f        |         | f       | f        |               | f            |
| 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   |         |         |          |          |         | +       |          |               |              |
| IEC 61850   | +       | +       | +        | +        | +       | +       | +        |               |              |
| IEC 61850 Edition 2                                     | +       |         |          |          | +       | +       |          |               |              |
| IEC 61850-9-2 Sampled Values Technology                 | +       |         |          |          |         |         |          |               |              |
| Simple Network Time Protocol (SNTP)                     | ■       | ■       | ■        | ■        | +       | +       | +        |               |              |
| Harmonic Metering                                       |         | ■       | ■        | ■        | ■       |         |          |               |              |
| RMS Metering  | ■       | ■       | ■        | ■        | ■       | ■       | ■        |               |              |

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



## Distribution Control



### SEL-FT50 and SEL-FR12

The SEL-FT50 and SEL-FR12 system improves distribution protection by providing fault indication in 6 ms, allowing relays and recloser controls to make better tripping decisions.



### SEL-651R

The SEL-651R provides Automatic Network Reconfiguration, three-phase and single-phase tripping, and other distribution automation solutions. It is compatible with popular reclosers.



### SEL-651RA

The SEL-651RA is a powerful, cost-effective, and flexible recloser control for 14-pin applications. It is compatible with popular reclosers.



### SEL-351RS Kestrel®

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



### SEL-734B

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

The enhanced SEL-734W and SEL-8340 Wireless Current Sensor solution provides advanced capacitor bank control to improve power quality.



### SEL-2431

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

| Applications  | SEL-351RS | SEL-651RA   | SEL-651R |
|---|-----------|-------------|----------|
| Distribution Feeder Protection  | ■         | ■           | ■        |
| Breaker Failure Protection  | <i>f</i>  | <i>f</i>    | <i>f</i> |
| Generator Intertie Protection   |           | ■           | ■        |
| Synchronism Check   |           | +           | ■        |
| Underfrequency Load Shedding  | ■         | ■           | ■        |
| Undervoltage Load Shedding  | ■         | ■           | ■        |
| <b>Protection</b>   |           |             |          |
| 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   | ■         | ■           | ■        |
| Separate Neutral Overcurrent  |           | ■           | ■        |
| Load Encroachment Supervision   |           | ■           | ■        |
| Low-Energy Analog (LEA) Voltage Inputs  |           | +           | +        |
| Directional Sensitive Earth Fault Protection                                      |           | ■           | ■        |
| Pilot Protection Logic  |           | <i>f</i>    | <i>f</i> |
| Rate-of-Change of Frequency (df/dt)   | ■         | ■           | ■        |
| Fast Rate-of-Change of Frequency  |           | ■           | ■        |
| Harmonic Blocking   | ■         | ■           | ■        |
| Arc Sense™ Technology (AST) High-Impedance Fault Detection                        |           | +           | +        |
| Phantom Phase Voltage   | ■         | ■           | ■        |
| Current/Voltage Channels  | 1/1       | 4/1<br>4/6+ | 4/6      |

| Instrumentation and Control                             | SEL-351RS | SEL-651RA | SEL-651R |
|---|-----------|-----------|----------|
| 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                      | ■         | ■         | ■        |
| Breaker/Recloser Wear Monitor                           | ■         | ■         | ■        |
| Trip Coil Monitor                                       | <i>f</i>  | <i>f</i>  | <i>f</i> |
| Voltage Sag, Swell, and Interruption (VSSI)             | ■         | +         | ■        |
| Load/Signal Profile Recorder                            | ■         | ■         | ■        |
| Sequential Events Recorder                              | ■         | ■         | ■        |
| DNP3 Level 2 Outstation                                 | ■         | ■         | ■        |
| IEEE C37.118 Synchrophasors                             | ■         | ■         | ■        |
| Ethernet  | ■         | ■         | ■        |
| IEC 61850   | +         | +         | +        |
| Simple Network Time Protocol (SNTP)                     | ■         | ■         | ■        |
| Harmonic Metering                                       | ■         | ■         | ■        |
| RMS Metering  | ■         | ■         | ■        |

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



## Fault Indicators, Sensors, and CTs



### SEL-FLT and SEL-FLR

Improve distribution reliability with the SEL-FLT and SEL-FLR system, which enables faster fault locating, reduces outage durations, and improves the average restoration time.



### SEL-AR360 and SEL-AR

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 up to 69 kV.



### SEL-ER

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



### SEL-BTRIP

Locate momentary and permanent faults in overhead applications. The SEL-BTRIP provides four field-selectable trip thresholds so you can stock one fault indicator for multiple applications.



### RadioRANGER®

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



### SEL-8301

Optimize outage management and improve underground system reliability.



### SEL-ARU

Use the Dynamic Delayed Trip feature to improve coordination with upstream protection, maximizing reliable performance.



### SEL-TPR

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-CR

Monitor underground systems with the SEL-CR, which is powered by the load current present on an energized line.





### SEL-SR

Apply the SEL-SR to pad-mounted transformers when there is insufficient primary current to power and reset current-powered fault indicators.



### SEL-TR

Indicate both momentary and permanent faults in underground distribution systems with low load and low voltage.



### SEL-MW

Use the SEL-MW in place of PTs to detect system voltage loss where exact system voltage measurement reporting is not required. The SEL-MW indicates voltage loss via a contact output.



### SEL-PILC

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-GFD

Apply the SEL-GFD over a three-phase cable bundle at ground potential in switch-gear to identify faults on circuits feeding medical facilities, mining equipment, and other industrial equipment.



### SEL-MR

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



### SEL-VIN

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



### SEL-CT

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



### SEL-SCT

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



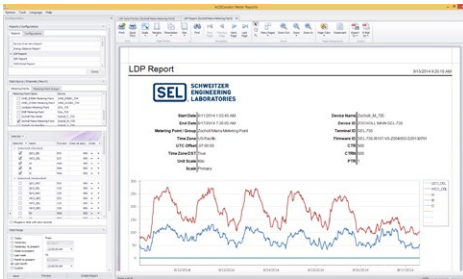
### SEL-735 Power Quality and Revenue Meter

Achieve high-accuracy revenue and power quality metering for any application. The SEL-735 offers 1 GB of recording memory for up to 20 years of storage and is now available with a color touchscreen display. Multiple enclosure and mounting options are available.



### Meter Installation Options and Accessories

Mount SEL meters and accessory devices into a variety of locations using a complete line of mounting kits. You can choose from rack-mount, wall-mount, indoor, or outdoor configurations. If you have an existing panel cutout, you can retrofit your meter using our retrofit bezels. For more information, visit [selinc.com/products/73x/meter-options](http://selinc.com/products/73x/meter-options).



### ACSELERATOR® Meter Reports

Transform metering data into action with ACSELERATOR Meter Reports SEL-5630 Software. The software offers interactive charts, fast database interrogation, and the ability to customize metering reports for utilities, industrial operations, and site-wide campus monitoring.



### ACSELERATOR Database API

Allow third-party systems to access ACSELERATOR TEAM® SEL-5045 Software data with the SEL-5230 ACSELERATOR Database API. This allows different enterprise-level systems, such as an energy management system or a billing system, to integrate data reporting.

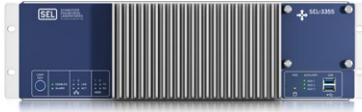
## SEL-735 Power Quality Options

| General   | Basic  | Intermediate                                   | Advanced   |
|---|--|--|--|
| Display   | Customizable three-line or single-line display | Customizable three-line or single-line display | Customizable three-line or single-line display; 5-inch, 800 × 480 color touchscreen display* |
| Type-C USB Front Port                                       | No   | No   | Yes*   |
| 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  |
| Portable Case   | No   | No   | Yes*   |
| <b>Waveform Capture</b>                                     |  |  |  |
| 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  |
| <b>Load Profile Data</b>                                    |  |  |  |
| 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  |
| <b>Storage Duration for 10-Minute Interval Data</b>         |  |  |  |
| 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  |
| <b>Voltage Sag, Swell, and Interruption (VSSI) Recorder</b> |  |  |  |
| 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   |
| <b>Sequential Events Recorder (SER)</b>                     |  |  |  |
| Number of Events  | >80,000  | >80,000  | >80,000  |
| Number of Channels Monitored                                | ≤72  | ≤72  | ≤72  |
| <b>IEC 61000-4-30 Power Quality Compliance</b>              |  |  |  |
| 150/180-Cycle, 10-Minute, 2-Hour Aggregation                | –  | Class A  | Class A  |
| Flicker   | –  | 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



## Automation



### SEL-3355

The SEL-3355 is a server-class automation controller built to withstand harsh environments in utility substations and industrial control and automation systems. It can be configured as an RTAC, as a computer, or with the SEL BlueFrame™ application platform.



### SEL-3360S/3360E

The SEL-3360S and SEL-3360E match the performance, ruggedness, and configuration flexibility of the SEL-3355 and are ideal for surface- or panel-mount applications.



### SEL-3350 **NEW**

The SEL-3350 is ideal for limited-space, dedicated embedded applications that require midlevel I/O and computation. It can be configured as an RTAC, as a computer, or with the SEL BlueFrame application platform.



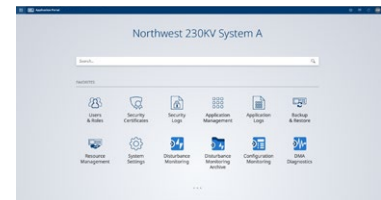
### SEL-3390

SEL PCIe expansion cards let you add ports and connectivity to various industrial automation platforms.



### SEL-9331

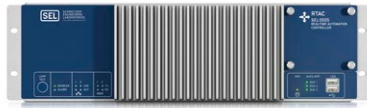
The SEL-9331 powers equipment in industrial environments where many power supplies cannot maintain operation.



### SEL BlueFrame **NEW**

Scalable and flexible, SEL BlueFrame provides a secure platform for installing applications and for managing and exchanging data between supported applications, like SEL Data Management and Automation applications.





### SEL-3555 RTAC

Powerful processing for large-scale automation projects.



### SEL-3560E/3560S RTACs

Powerful processing for large-scale automation projects in a compact form factor.



### SEL-3530/3530-4 RTACs

Complete and flexible system control with integrated security, seamless configuration, unified logic, and high reliability.



### SEL-3505/3505-3 RTACs

Powerful automation, reporting, and control for low-power, limited-space applications.



### SEL-2240 Axion®

A fully integrated, modular I/O and control solution for utility and industrial applications.



### SEL-2411P

Hardened, SCADA-ready pump automation controller with flexible I/O that is easy to install, set, and customize.



### SEL-2411

Flexible I/O for automatic control, SCADA, station integration, remote monitoring, and plant control systems.



### SEL-2440

Utility-grade I/O, powerful processing, flexible communications, and microsecond timing.

| Applications   | SEL-3355 | SEL-3360E | SEL-3360S | SEL-3350 |
|--|----------|-----------|-----------|----------|
| Computing in Harsh Environments  | ■        | ■         | ■         | ■        |
| Running Multiple Applications Simultaneously   | ■        | ■         | ■         | ■        |
| Installing Third-Party Software  | ■        | ■         | ■         | ■        |
| Embedding Into Automation and Monitoring Systems                                       | ■        | ■         | ■         | ■        |
| HMI  | ■        | ■         | ■         | ■        |
| Security Gateway 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 | ■        | ■         | ■         | ■        |
| SEL Secure Kiosk   | ■        | ■         | ■         | ■        |
| Parallel Redundancy Protocol (PRP)   | ■        | ■         | ■         | ■        |

### Supported Operating Systems and Software

|  |   |   |   |   |
|--|---|---|---|---|
| SEL Real-Time Automation Controller (RTAC)*        | + | + | + | + |
| SEL BlueFrame™ Operating System (With Kiosk Mode)* | + | + | + | + |
| SEL Software*                                      | + | + | + | + |
| Microsoft Windows 10 IoT Enterprise LTSC*          | + | + | + | + |
| Windows Server 2019 Standard*                      | + | + | + | + |
| McAfee Whitelist Antivirus*                        | + | + | + | + |

See Page 162 for a complete list of operating system options.

### Hardware

|  |   |   |   |   |
|--|---|---|---|---|
| Intel Xeon E3-1505L Quad-Core 2.0 GHz 64-Bit CPU                       | ■ | ■ | ■ |   |
| Intel Xeon E3-1515M Quad-Core 2.8 GHz 64-Bit CPU                       | + |   | + |   |
| Intel Atom x5-E3940 Quad-Core 1.6 GHz 64-Bit CPU                       |   |   |   | ■ |
| 4 GB DDR4 ECC PC4-17000 (2,133 MHz) System Memory                      | ■ | ■ | ■ |   |
| Up to 32 GB DDR4 ECC PC4-17000 System Memory                           | + | + | + |   |
| 8 GB DDR3L ECC PC3-1600 (800 MHz) System Memory                        |   |   |   | ■ |
| Triple Independent Video Displays (2 DVI-D and 1 DisplayPort)          | ■ | ■ | ■ |   |
| Single DisplayPort With Audio Output (3 Monitors With DisplayPort Hub) |   |   |   | ■ |
| HD Audio Ports, Line In, Line Out, Microphone                          | ■ | ■ | ■ |   |

### Hardware (Continued)

|  |    |    |   |    |
|--|----|----|---|----|
| 4 Rear and 2 Front USB Ports, USB 3.1-Compliant, 2.0 A Max. Current Limit Each   | ■  | ■  | ■ |    |
| 4 Rear USB 2.0 Ports and 2 Front USB 3.1 Ports, 1.5 A Combined Current on Front Ports, 1.5 A Combined Current on Rear Ports      |    |    |   | ■  |
| Front 10/100/1000 Mbps Independent Copper Ethernet Ports   |    |    |   | ■  |
| Rear 10/100/1000 Mbps Independent Ethernet Ports   | 2  | 2  | 2 |    |
| Copper RJ45 and Fiber Small Form-Factor Pluggable (SFP) Ports (4 RJ45, 2 RJ45 and 2 SFP, or 4 SFP)                               |    |    |   | ■  |
| EIA-232 Serial Ports, DB-9 Connectors, 300 to 115,000 bps  | 2  | 2  | 2 |    |
| EIA-232/422/485 Serial Ports, RJ-45 Connectors, 300 to 115,200 bps, IRIG-B Output  |    |    |   | 16 |
| IRIG-B Input (on COM1)   | ■  | ■  | ■ |    |
| IRIG-B Input and Output (PCIe Card)  | +  | +  |   |    |
| IRIG-B Input and Output (BNC and Serial)   |    |    |   | ■  |
| 19" Rack-Mount Chassis   | ■  |    |   | ■  |
| Panel Mount  | +  |    |   | +  |
| Wall-Mount Chassis   |    | ■  | ■ |    |
| Conductive Panel Mount   |    | +  | + |    |
| PCI/PCIe Expansion Slots   | 5  | 2  |   |    |
| Additional EIA-232/422/485 Serial Ports, RJ45 Connectors, 300 to 921,000 bps, IRIG-B Inputs/Outputs, +5 Vdc Power Via PCIe Cards | 24 | 12 |   |    |
| Additional 10/100/1000 Mbps Ethernet Ports, Copper RJ45, or Fiber-Optic SFP LC Connectors Via PCIe Cards                         | 8  | 8  |   |    |
| Solid-State Drives (2.5" SLC, iMLC, MLC SATA II, 32 GB–7.6 TB Drives)  | 4  | 2  | 2 | 2  |
| Internal 120/230 Vac, 125/250 Vdc, or 48 Vdc Power Supply  | ■  | ■  |   | ■  |
| Internal Low-Voltage 24–48 Vdc Power Supply  |    |    |   | ■  |
| Secondary 120/230 Vac, 125/250 Vdc, or 48 Vdc Power Supply   | +  |    | + |    |
| Hot-Swappable Power Supplies   | ■  |    | ■ |    |
| External Power Supply  |    |    | + |    |
| Alarm Contact, Alarm LED, Watchdog Processor   | ■  | ■  | ■ | ■  |
| Configurable Universal Control Input   |    |    |   | ■  |
| Programmable Auxiliary Bicolor LEDs  | 3  | 3  | 3 | 4  |
| Intel Active Management Technology (AMT) v11.8   | ■  | ■  | ■ |    |
| Infineon Trusted Platform Module (TPM) v2.0 (Hardware)   | ■  | ■  | ■ | ■  |

■ Standard feature    + Model option    \*Factory-orderable operating system

| Applications  | SEL-3555<br>SEL-3560E/3560S | SEL-3530 | SEL-3530-4 | SEL-2240 | SEL-3505/3505-3 | SEL-3532/3533  | SEL-2411 | SEL-2411P | SEL-2440 |
|---|-----------------------------|----------|------------|----------|-----------------|----------------|----------|-----------|----------|
| Collect, Scale Meter Data                                 | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         |          |
| Collect Targets, Contact Input Status, Fault Location     | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Enable Fiber-Optic Links                                  | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         | ■        |
| Control Through IED Outputs                               | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Accept IRIG-B Time Synchronization                        | ■                           | ■        | ■          | ■        | +               | +              | ■        | ■         | ■        |
| Provide IRIG-B Time Synchronization                       | ■                           | ■        | ■          | ■        | +               | +              |          |           |          |
| Transparent “Port Switch”                                 | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         | ■        |
| Web Server HMI  | +                           | +        | +          | +        |                 | +              |          |           |          |
| <b>Concentrate IED Data For:</b>                          |                             |          |            |          |                 |                |          |           |          |
| Distributed Control System (DCS)                          | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| SCADA Master or Remote Terminal Unit (RTU)                | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Local or Remote HMI                                       | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| <b>Features</b>   |                             |          |            |          |                 |                |          |           |          |
| Protocol Redundancy (DNP3 and IEC 60870-5 101/104 Server) | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Primary and Standby LAN Support                           | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         | ■        |
| Optoisolated Inputs/Programmable Outputs                  | ■ <sup>1</sup>              | +        | ■          | +        | +               | ■ <sup>1</sup> | +        | +         | +        |
| Rack-Mount or Panel-Mount Hardware                        | ■ <sup>2</sup>              | +        | +          | +        |                 | ■              | +        | +         | +        |
| IEC 61131 Logic Engine                                    | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Cybersecurity Management                                  | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Real-Time Operating System                                | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         | ■        |
| <b>Serial Port Protocols</b>                              |                             |          |            |          |                 |                |          |           |          |
| SEL MIRRORING BITS® Communications                        | ■                           | ■        | ■          | ■        | ■               | ■              | ■        | ■         | ■        |
| <b>Client</b>   |                             |          |            |          |                 |                |          |           |          |
| DNP3  | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| Modbus RTU  | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| LG 8979   | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| CP 2179   | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| SEL Fast Messages, Interleaved With ASCII                 | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| SEL Synchrophasors  | f                           | f        | f          | f        | f               | f              |          |           |          |
| IEC 60870-5 101   | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| SES-92  | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |
| ASCII Flex Parse  | ■                           | ■        | ■          | ■        | ■               | ■              |          |           |          |

| Serial Port Protocols (Continued)                         | SEL-3555<br>SEL-3560E/3560S | SEL-3530 | SEL-3530-4 | SEL-2240 | SEL-3505/3505-3 | SEL-3532/3533 | SEL-2411 | SEL-2411P | SEL-2440 |
|---|-----------------------------|----------|------------|----------|-----------------|---------------|----------|-----------|----------|
| <b>Server</b>   |                             |          |            |          |                 |               |          |           |          |
| DNP3  | ■                           | ■        | ■          | ■        | ■               | ■             | +        | ■         | +        |
| Modbus RTU Binary   | ■                           | ■        | ■          | ■        | ■               | ■             | ■        | ■         | ■        |
| IEC 60870-5-101   | ■                           | ■        | ■          | ■        | ■               | ■             |          |           |          |
| LG 8979   | ■                           | ■        | ■          | ■        | ■               | ■             |          |           |          |
| SES-92  | ■                           | ■        | ■          | ■        | ■               | ■             |          |           |          |
| <b>Network Protocols</b>                                  |                             |          |            |          |                 |               |          |           |          |
| Telnet  | ■                           | ■        | ■          | ■        | ■               | ■             | ■        | ■         | ■        |
| FTP   |                             |          |            |          |                 |               | ■        | ■         | ■        |
| 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/CDC Type 2 Client/Server                      | ■                           |          |            |          |                 |               |          |           |          |
| Lightweight Directory Access Protocol (LDAP)              | ■                           | ■        | ■          | ■        | ■               | ■             |          |           |          |
| EtherCAT®   | ■ <sup>3</sup>              | ■        | ■          | ■        |                 | ■             |          |           |          |
| EtherNet/IP   | ■ <sup>3</sup>              | ■        | ■          | ■        | ■               | ■             |          |           |          |
| Precision Time Protocol (PTP)/Network Time Protocol (NTP) | ■                           | ■        | ■          | ■        | ■               | ■             |          |           |          |
| Simple Network Time Protocol (SNTP)                       | ■                           | ■        | ■          | ■        | ■               | ■             | ■        | ■         | ■        |
| Parallel Redundancy Protocol (PRP)                        | ■                           | ■        | ■          | ■        | ■               | ■             | ■        | ■         | ■        |

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

<sup>1</sup>Alarm contact only    <sup>2</sup>SEL-3560E/3560S are surface-mount only

<sup>3</sup>Not supported on SEL-3560S



## WAN and LAN Networks



### SEL ICON®

The SEL ICON is a WAN multiplexer optimized for industrial and utility applications. By combining 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-2740S

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



### SEL-2742S **NEW**

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



### SEL-3620/3622

The SEL-3620 and SEL-3622 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/2730U

The SEL-2730M/2730U let you build reliable, safe Ethernet networks in electrical substations, plants, and other mission-critical sites.



### SEL-3610

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

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



### SEL-3025

The SEL-3025 protects serial communications with bump-in-the-wire security and strong, authenticated access controls.



| Applications   | SEL ICON® | SEL-3620 | SEL-3622 | SEL-3610 | SEL-2725 | SEL-2730M | SEL-2740S | SEL-2742S | SEL-2890 |
|--|-----------|----------|----------|----------|----------|-----------|-----------|-----------|----------|
| SONET WAN  | ■         |          |          |          |          |           |           |           |          |
| Ethernet LAN   | ■         | ■        | ■        | ■        | ■        | ■         | ■         | ■         | ■        |
| Precise Time Distribution  | ■         | ■        | ■        | ■        |          |           | ■         | ■         |          |
| Engineering Access Control   |           | ■        | ■        | ■        |          |           | ■         | ■         |          |
| 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  | ■              | ■ | ■ | ■ |  | ■              | ■ | ■ |  |
| Centralized Authentication Via Lightweight Directory Access Protocol (LDAP)        | ■ <sup>6</sup> | ■ | ■ | ■ |  | ■              | ■ | ■ |  |
| Centralized Authentication Via Remote Authentication Dial-In User Service (RADIUS) |                | ■ | ■ | ■ |  | ■              |   |   |  |
| Deny-by-Default Firewall   |                | ■ | ■ |   |  |                |   |   |  |
| Import/Export Configuration Files  |                | ■ | ■ | ■ |  | ■              | ■ | ■ |  |
| VPN  |                | ■ | ■ |   |  |                |   |   |  |
| Syslog Logging   | ■              | ■ | ■ | ■ |  | ■              | ■ | ■ |  |
| Network Management System (NMS) Software   | ■              |   |   |   |  | ■              | ■ | ■ |  |
| GPS Receiver   | ■              |   |   |   |  |                |   |   |  |
| Real-Time Latency Monitor  | ■              |   |   |   |  |                |   |   |  |
| Spanning Tree Protocol (STP)   |                | ■ | ■ | ■ |  | ■ <sup>1</sup> |   |   |  |
| VLANs  | ■              | ■ | ■ | ■ |  | ■              | ■ | ■ |  |
| Ethernet Class of Service  | ■              |   |   |   |  | ■              | ■ | ■ |  |

## Ethernet Ports, Connector

## Quantities

|   |                                |   |   |   |     |                   |      |      |   |
|---|--------------------------------|---|---|---|-----|-------------------|------|------|---|
| Copper 10BASE-T, RJ45                   |                                |   |   |   |     |                   |      |      | 1 |
| Copper 10/100BASE-T, RJ45               | 0–16 <sup>2</sup>              | 3 | 3 | 3 | 3–5 | 0–16 <sup>3</sup> | 0–20 | 2–10 |   |
| Fiber-Optic 100BASE-FX, LC              | 4                              | 2 | 2 | 2 | 0–2 | 0–16 <sup>3</sup> | 0–20 | 0–6  |   |
| Copper Gigabit Ethernet (GigE), RJ45    | 4                              |   |   |   |     | 4                 | 0–4  | 0–4  |   |
| Fiber-Optic GigE, LC                    | 2 <sup>6</sup> /4 <sup>7</sup> |   |   |   |     | 0–4 <sup>4</sup>  | 0–4  | 0–4  |   |
| Small Form-Factor Pluggable (SFP) Cages | 2–6 <sup>5</sup>               |   |   |   |     | 4 <sup>4</sup>    |      |      |   |

<sup>1</sup>SEL-2730M supports STP plus IEEE 802.1D-2004 Rapid Spanning Tree Protocol (RSTP).

<sup>2</sup>SEL ICON can support up to 16 Ethernet ports using 8-port Ethernet Access Modules or Ethernet Bridging Access Modules.

<sup>3</sup>SEL-2730M base configuration supports sixteen 10/100BASE-T copper ports, with the option to substitute 100BASE-FX fiber-optic ports in groups of four.

<sup>4</sup>SEL-2730M base configuration includes 4 copper GigE ports and 4 SFP cages for optional fiber-optic GigE ports.

<sup>5</sup>SEL ICON uses SFP cages for SONET and GigE fiber-optic interfaces.

<sup>6</sup>SEL-8021-1 Line Module supports 2 fiber-optic Gigabit interfaces.

<sup>7</sup>SEL-8036-1 Ethernet Bridging Access Module supports 4 fiber-optic 100BASE-FX/Gigabit interfaces.

<sup>8</sup>SEL-5052 Server NMS Software provides LDAP centralized authentication for the ICON.



## Wireless Communications



### SEL-3031

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

The SEL-3061 provides remote access for devices using the public cellular radio network. It supports 4G LTE, 3G, and 2G cellular technologies.



### SEL-2924

The portable SEL-2924 connects to an EIA-232 port on a relay, controller, or other device to enable secure Bluetooth® wireless communications from up to 10 m (32 ft) away.



### SEL-2925

The SEL-2925 connects to an EIA-232 serial port in a control cabinet or panel to enable Bluetooth wireless communications from up to 100 m (328 ft) away.

| Applications   | SEL-3031 | SEL-3061 | SEL-2924 | SEL-2925 |
|--|----------|----------|----------|----------|
| Wireless Communications for SCADA                                | ■        | ■        |          | ■        |
| High-Speed Teleprotection  | ■        |          |          |          |
| Distribution Automation  | ■        | ■        |          |          |
| Wireless Communications for Synchrophasor Data                   | ■        | ■        |          |          |
| Substation-to-Substation Communications Link                     |          | ■        |          |          |
| Anti-Island Detection  | ■        | ■        |          |          |
| Wireless Communications for Distributed Generation               | ■        | ■        |          |          |
| Permanent Wireless Cable Replacement                             | ■        | ■        |          | ■        |
| Temporary 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)                          | ■        |   |   |   |
| 2.4 GHz 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   | <i>f</i> | ■ | ■ | ■ |
| Point-to-Multipoint Capability                           | ■        |   |   |   |
| Cellular Capability                                      |          | ■ |   |   |
| EIA-232 Port (Quantity)                                  | 3        | 1 | 1 | 1 |
| Wired EIA-485 Port                                       | +        |   |   |   |
| High Maximum Throughput (1 Mbps or Greater)              |          | ■ |   |   |
| Device Status LEDs                                       | ■        | ■ | ■ | ■ |
| Visible Link Quality Indicator                           |          | ■ |   |   |

■ Standard feature    + Model option    *f* With SEL-3044 Encryption Card option

| Setup Method                              | SEL-3031 | SEL-3061 | SEL-2924 | SEL-2925 |
|---|----------|----------|----------|----------|
| USB Port                                  | ■        |          |          |          |
| Secure Web Interface Via Ethernet Port    |          | ■        |          |          |
| Control (DIP) Switches                    |          |          | ■        | ■        |
| Wireless Configuration                    | ■        | ■        | ■        | ■        |
| Simple Network Management Protocol (SNMP) |          | ■        |          |          |



## Precise Time



### SEL-2488

The SEL-2488 receives GNSS time signals and distributes precise time via multiple output protocols, including IRIG-B, PTP, and NTP, with  $\pm 40$  ns accuracy.



### SEL-2407®

The SEL-2407 provides a time display and high-accuracy timing ( $\pm 100$  ns).



### SEL-2401

The SEL-2401 is a satellite clock with high-accuracy timing ( $\pm 100$  ns) for compact spaces.



### SEL-2404

The SEL-2404 is a high-accuracy ( $\pm 100$  ns) satellite clock with a highly visible time display.



### SEL-3401

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

The SEL-9929 kit includes a satellite-synchronized clock, a large digital clock display, and all accessories to work right out of the box.



### SEL-3400

The SEL-3400 verifies time signals and distributes precise time to 240 devices.



### SEL-3405

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



### SEL-9524

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

| Applications   | SEL-2401 | SEL-2404 | SEL-2407® | SEL-3400 | SEL-3401 | SEL ICON® | SEL-2488 |
|--|----------|----------|-----------|----------|----------|-----------|----------|
| Time Source for Substation   | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Time Source for Industrial Applications                                      | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Time Source for Phasor Measurement Unit (IEEE C37.118.1-2011 Synchrophasors) | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Time Source for Recloser   | ■        |          | ■         |          |          |           |          |
| Time Source for Line Current Differential Protection                         | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Time Source for Traveling-Wave Fault Location                                | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Time-Synchronized Event Reporting  | ■        | ■        | ■         | ■        |          | ■         | ■        |
| Long-Distance Viewing, 61 m (200 ft)   |          | ■        |           |          | ■        |           |          |

### Time Sources and Time Distribution

|  |   |   |   |    |    |   |         |
|--|---|---|---|----|----|---|---------|
| Demodulated IRIG-B Outputs (Quantity)  | 1 | 4 | 6 | 12 | 4+ | 4 | up to 8 |
| Modulated IRIG-B Outputs (Quantity)  |   |   | 1 |    |    |   | up to 4 |
| GPS Satellite Tracking   | ■ | ■ | ■ |    |    | ■ | ■       |
| GLONASS Satellite Tracking (Reference Only)                                      |   |   |   |    |    |   | ■       |
| Demodulated IRIG-B Input   |   |   |   | ■  | ■  | ■ |         |
| Synchronized Pulse Output  | ■ | ■ | ■ |    |    |   | ■       |
| Network Time Protocol (NTP) Server   |   |   |   |    |    |   | ■       |
| IEEE 1588 Precision Time Protocol (PTP) (With IEEE C37.238 Power System Profile) |   |   |   |    |    | ■ | +       |
| Satellite Signal Verification  |   |   |   |    |    |   | ■       |

### Features

|  |   |   |   |   |   |   |   |
|--|---|---|---|---|---|---|---|
| 76.2 mm (3.0 in) LED Display   |   | ■ |   |   | ■ |   |   |
| 14 mm (0.56 in) LED Display  |   |   | ■ | ■ |   |   | ■ |
| Rack-Mount Hardware  | ■ | ■ | ■ | ■ | ■ | ■ | ■ |
| Panel-Mount or Wall-Mount Hardware                                     | ■ | ■ | ■ | ■ | ■ | ■ |   |
| Universal Power Supply   |   |   | ■ | ■ |   | ■ | ■ |
| Dual, Redundant, Hot-Swappable Power Supplies                          |   |   |   |   |   | ■ | ■ |
| Power Over Ethernet (PoE) Power Sourcing Equipment (PSE)               |   |   |   |   |   | ■ |   |
| Secure Web Interface for Configuration                                 |   |   |   |   |   |   | ■ |
| Serial Ports for Configuration   | ■ | ■ | ■ |   |   |   |   |
| User-Based Accounts  |   |   |   |   |   | ■ | ■ |
| TCXO Holdover  | ■ | ■ | ■ |   |   | ■ | ■ |
| OCXO Holdover  |   |   |   |   |   |   | + |
| Time-Code Cable Delay Compensation                                     |   |   |   | ■ |   | ■ | ■ |
| IEEE C37.90 and IEC 60255 Surge and Environmental Standards Compliance | ■ | ■ | ■ | ■ | ■ | ■ | ■ |

### Accuracy

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

■ Standard feature    + Model option/accessory





## Transceivers and Adapters



### SEL-2800/2815

Improve safety, signal integrity, and reliability of EIA-232 communications by using multimode SEL-2800/2815 Fiber-Optic Transceivers instead of wire.



### SEL-2810/2812/2814

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

Apply the SEL-2829/2830/2831 Single-Mode Fiber-Optic Transceiver/Modem to use two optical fibers instead of wire to transfer bidirectional serial data.



### SEL-2820/2824

Apply SEL-2820/2824 Multimode Fiber-Optic Transceivers to safely add isolated segments to multidrop and point-to-point EIA-485 networks.



### SEL-2890

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



### SEL-9192

Connect remote terminal units (RTUs), communications processors, and other equipment with the SEL-9192 Utility-Grade USB Modem for dial-up or dial-out engineering access.



### SEL-9220

Convert the EIA-485 port of an SEL-300 series relay to a point-to-point fiber-optic port with the SEL-9220 Fiber-Optic Adapter for SEL-300 Series Relays.



### SEL-2894

Apply the SEL-2894 Interface Converter to transfer SEL MIRRORED BITS® communications via an IEEE C37.94 fiber-optic link through a communications multiplexer.



### SEL-2886

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

|   | SEL-2800 | SEL-2810 | SEL-2812 | SEL-9220 | SEL-2814 | SEL-2815 | SEL-2820 | SEL-2824 | SEL-2829 | SEL-2830 | SEL-2831 | SEL-2894 |
|---|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|----------|
| <b>Connector and Optics</b>                             |          |          |          |          |          |          |          |          |          |          |          |          |
| V-Pin, 650 nm Wavelength                                | ■        | ■        |          |          |          |          | ■        |          |          |          |          |          |
| ST, 850 nm Wavelength                                   |          |          | ■        | ■        | ■        | ■        |          | ■        |          |          |          | ■        |
| ST, 1,300 nm Wavelength                                 |          |          |          |          |          |          |          |          | ■        | ■        |          |          |
| ST, 1,550 nm Wavelength                                 |          |          |          |          |          |          |          |          |          |          | ■        |          |
| <b>Fiber Compatibility</b>                              |          |          |          |          |          |          |          |          |          |          |          |          |
| 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)                  |          |          |          |          |          |          |          |          | ■        | ■        | ■        |          |
| <b>Electrical Features</b>                              |          |          |          |          |          |          |          |          |          |          |          |          |
| 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                        |          |          |          |          | ■        |          | ■        | ■        |          |          |          |          |
| <b>Distances</b>  |          |          |          |          |          |          |          |          |          |          |          |          |
| 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



## Cables



### SEL-C804

Use SEL-C804 Multimode Arc-Flash Detection Fiber-Optic Cables with the SEL-751, SEL-751A, and SEL-710-5 to detect arc-flash events.



### SEL-C805

Connect V-pin or ST ports with SEL-C805 200 µm Multimode Fiber-Optic Cable assemblies.



### SEL-C807

Use SEL-C807 62.5/200 µm Multimode Fiber-Optic Cable assemblies to connect ST or LC ports.



### SEL-C808

Connect ST, SC, or LC ports with SEL-C808 62.5/125 µm Multimode Fiber-Optic Cable assemblies.



### SEL-C809

Use SEL-C809 9 µm Single-Mode Fiber-Optic Cable assemblies to connect ST, SC, or LC 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.



### Coaxial Cables

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



### Category 5e Ethernet

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



### 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.

| 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                                 |          |           |           |           |           |           | ■         | ■         | ■         | ■         | ■         | ■         |
| <b>Fiber Diameter (Core/Outer)</b> |          |           |           |           |           |           |           |           |           |           |           |           |
| 1,000 µm                           | ■        |           |           |           |           |           |           |           |           |           |           |           |
| 200 µm                             |          | ■         | ■         | ■         |           |           |           |           |           |           |           |           |
| 62.5/200 µm                        |          |           |           |           | ■         | ■         |           |           |           |           |           |           |
| 62.5/125 µm                        |          |           |           |           |           |           | ■         | ■         | ■         |           |           |           |
| 9/125 µm                           |          |           |           |           |           |           |           |           |           | ■         | ■         | ■         |
| <b>Wavelength</b>                  |          |           |           |           |           |           |           |           |           |           |           |           |
| 650 nm (Multimode)                 |          | ■         | ■         | ■         |           |           |           |           |           |           |           |           |
| 850 nm (Multimode)                 |          | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         |           |           |           |
| 1,300 nm (Multimode)               |          |           |           |           | ■         | ■         | ■         | ■         | ■         |           |           |           |
| 1,300–1,550 nm (Single-Mode)       |          |           |           |           |           |           |           |           |           | ■         | ■         | ■         |
| <b>Fiber Count</b>                 |          |           |           |           |           |           |           |           |           |           |           |           |
| Simplex (1 Fiber)                  | ■        | ■         |           |           | ■         |           | ■         | ■         |           | ■         | ■         |           |
| Duplex (2 Fibers)                  | ■        | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         |
| Quad (4 Fibers)                    |          |           | ■         | ■         |           | ■         |           |           | ■         |           |           |           |
| <b>Cable Ratings</b>               |          |           |           |           |           |           |           |           |           |           |           |           |
| Riser-Rated (OFNR)                 |          | ■         | ■         |           | ■         |           | ■         |           | ■         | ■         |           | ■         |
| Plenum-Rated (OFNP)                |          |           |           |           |           |           | ■         |           |           |           | ■         |           |
| Water-Blocked                      |          |           | ■         |           |           |           |           |           |           |           |           |           |
| Waterproof                         |          |           |           | ■         |           | ■         |           |           | ■         |           |           | ■         |

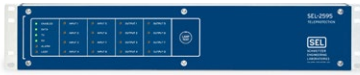
| Jacket Material                        | SEL-C804 | SEL-C805Z | SEL-C805D | SEL-C805G | SEL-C807Z | SEL-C807G | SEL-C808Z | SEL-C808P | SEL-C808G | SEL-C809Z | SEL-C809P | SEL-C809G |
|--|----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|-----------|
| Polyvinyl Chloride (PVC)               |          | ■         | ■         |           | ■         |           | ■         | ■         | ■         | ■         | ■         | ■         |
| Polyethylene (PE)                      | ■        |           |           | ■         |           | ■         |           |           |           |           |           |           |
| <b>Termination kits</b>                |          |           |           |           |           |           |           |           |           |           |           |           |
| V-Pin Termination Kit                  | ■        | ■         | ■         | ■         |           |           |           |           |           |           |           |           |
| ST Termination Kit                     | ■        | ■         | ■         | ■         | ■         | ■         |           |           |           |           |           |           |
| LC, ST, and SC Termination Kit         |          |           |           |           |           |           | ■         | ■         | ■         | ■         | ■         | ■         |
| <b>Options</b>                         |          |           |           |           |           |           |           |           |           |           |           |           |
| Bulk (No Connectors)                   | ■        | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         | ■         |
| Pulling Loop                           |          |           | ■         | ■         |           | ■         |           |           | ■         |           |           |           |
| <b>Fiber-Optic Compatibility</b>       |          |           |           |           |           |           |           |           |           |           |           |           |
| 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



### SEL-2505/2506/2507

Reduce operating time, add self-wiring, and simplify wiring for auxiliary inputs and outputs with the SEL-2505 Remote I/O Module, SEL-2506 Rack-Mount Remote I/O Module, and SEL-2507 High-Speed Remote I/O Module.



### SEL-2595

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



### SEL-2515/2516

Extend contact I/O for SEL information processors with the SEL-2515 Remote I/O Module and the SEL-2516 Rack-Mount Remote I/O Module. They monitor the status of external contacts transmitted via SEL Fast Meter messages to a communications processor and can control contact outputs using SEL Fast Operate commands.



### SEL-3094

Implement the SEL-3094 Interface Converter to convert electrical teleprotection interfaces to the IEEE C37.94 optical standard for improved safety, signal integrity, and communication over longer distances. Connecting an SEL-3094 to an ITU-T G.703, EIA-422, EIA-485, or EIA-232 device lets you use up to 2 km (1.2 mi) of optical fiber to link to an IEEE C37.94 multiplexer.

| Applications   | SEL-2505       | SEL-2506       | SEL-2507       | SEL-2515       | SEL-2516       | SEL-2595 |
|--|----------------|----------------|----------------|----------------|----------------|----------|
| Save Wiring Via I/O Multiplexing   | ■              | ■              | ■              | ■              | ■              | ■        |
| I/O for SEL Relays/SEL-3530/SEL-2100   | ■ <sup>1</sup> | ■ <sup>1</sup> | ■ <sup>1</sup> |                |                |          |
| I/O for Information Processors   |                |                |                | ■ <sup>1</sup> | ■ <sup>1</sup> |          |
| Transfer I/O to SEL-2505/2506/2507   | ■              | ■              | ■              |                |                |          |
| Transfer I/O to SEL-2507/T400L With Millisecond MIRRORING BITS® Communications |                |                | ■              |                |                |          |
| Transfer I/O to SEL-2594/2595  |                |                |                |                |                | ■        |
| Teleprotection   | ■              | ■              | ■              |                |                | ■        |
| Improve Safety With Optical Fiber  | ■              | ■              | ■              | ■              | ■              | ■        |

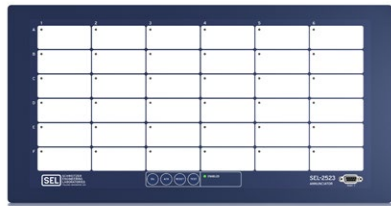
| Number of I/O Channels                 | SEL-2505 | SEL-2506 | SEL-2507 | SEL-2515 | SEL-2516 | SEL-2595 |
|--|----------|----------|----------|----------|----------|----------|
| Digital Inputs (DI) Base               | 8        | 8        | 8        | 8        | 8        | 8        |
| DI Maximum                             | 8        | 8        | 8        | 8        | 8        | 8        |
| Digital Outputs (DO) Base              | 8        | 8        | 8        | 8        | 8        | 8        |
| DO Maximum                             | 8        | 8        | 8        | 8        | 8        | 8        |
| <b>Serial Communications Protocols</b> |          |          |          |          |          |          |
| SEL MIRRORING BITS Communications      | ■        | ■        | ■        |          |          |          |
| SEL Fast Messages                      |          |          |          | ■        | ■        |          |
| IEEE C37.94                            |          |          |          |          |          | ■        |

■ Standard feature    <sup>1</sup>With compatible SEL fiber-optic transceiver or interface option at relay or processor





# Annunciation and Notification



## SEL-2523

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



## SEL-2522

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



## SEL-2533

Use the compact, ten-window SEL-2533 Annunciator 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

|                              | SEL-2522 | SEL-2523 | SEL-2533 |
|------------------------------|----------|----------|----------|
| 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                           |          | 3        | 3        |
| Optional Additional EIA-232 or EIA-485 Port |          | 1        | 1        |
| IRIG-B Time Input                           |          | 1        | 1        |
| ISA Annunciation Alarm Sequence Choices     | 2        | 8        | 8        |

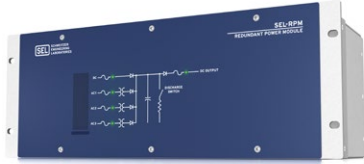
### Serial Communications Protocols

|                                   | SEL-2522 | SEL-2523 | SEL-2533 |
|-----------------------------------|----------|----------|----------|
| SEL MIRRORED BITS® Communications |          | ■        | ■        |
| SEL Fast Messages                 |          | ■        | ■        |
| Send SEL Messenger Points         |          | ■        | ■        |
| Modbus RTU                        |          | ■        | ■        |
| DNP3 Level 2 Outstation           |          | +        | +        |

■ Standard feature    + Model option



## Accessories and Tools



### SEL-RPM

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).



### SEL-4388

Accelerate commissioning and bench testing of SEL MIRRORED BITS® links and improve training, maintenance, and cable identification with the SEL-4388 MIRRORED BITS Tester.



### SEL-4520

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



### SEL-2652

Verify circuit breaker or lockout relay trip coil and trip circuit connections with the SEL-2652 Trip Coil Monitor.



### SEL-9510

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



### SEL-2126

Apply the SEL-2126 Fiber-Optic Transfer Switch to reroute IEEE C37.94 communications for bypass breaker protection during circuit breaker or station bypass operations.



### SEL-2910

Use the SEL-2910 Port Isolator to protect the EIA-232 ports of data terminal or communications equipment from induced voltages.



### SEL-9501/9502

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

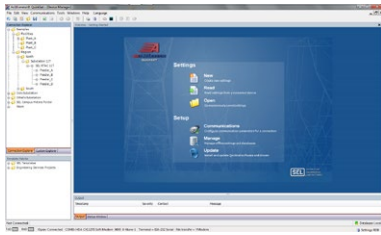


### SEL-9321 and SEL-9322

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

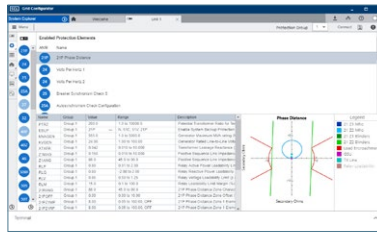


## Software



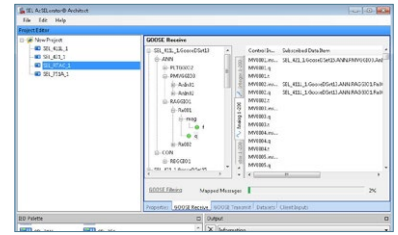
### ACSELERATOR QuickSet®

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



### SEL Grid Configurator **NEW**

Grid Configurator is the next evolution in SEL device configuration software, allowing you to quickly and confidently create, manage, and deploy settings.



### ACSELERATOR Architect®

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



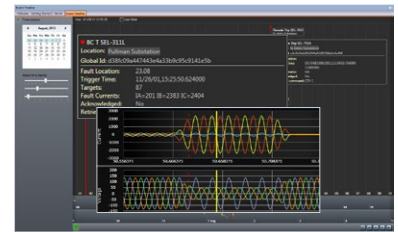
### SEL RTAC HMI

The SEL Real-Time Automation Controller (RTAC) HMI offers an easy way to visualize data to monitor and control your system.



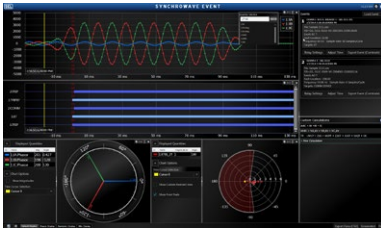
### ACSELERATOR Diagram Builder™

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



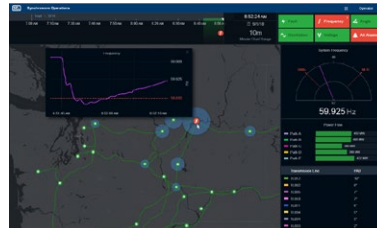
### ACSELERATOR TEAM®

TEAM automates the collection of power system data from multiple devices and stores the data in a central location for easy access.



### SYNCHROWAVE® Event

SYNCHROWAVE Event allows you to display and analyze SEL relay event reports and COMTRADE files.



### Synchrowave Operations **NEW**

Synchrowave Operations improves operator situational awareness with wide-area visualization and analytics solutions for real-time power system operations.



### Software-Defined Network Flow Controller

The SEL-5056 Flow Controller is the central interface for the commissioning, configuration, and monitoring of all SEL SDN-enabled Ethernet switches.



## Engineering Services



## Protection

### Protection Services

Protection solutions and related services for electric power systems, including scheme designs, relay settings, and more.

### Substation Engineering Services

Comprehensive solutions for power and substation design projects, from initial cost estimates to a completed substation.

### Arc-Flash Risk-Assessment Services

Flexible, customized arc-flash risk assessment services to improve employee safety and address regulations.

### Transmission Planning Services

Transmission planning analysis and design services over a wide range of study scenarios, from 69 kV to 525 kV.

### Synchronizing Systems

Conventional and advanced generator and microgrid synchronizing systems with automatic and manual synchronizing.

### Phase-Shifting Transformer (PST) Protection and Control Systems

Pre-engineered PST protection systems based on the SEL-487E Transformer Protection Relay.

### Digital Secondary System Solutions

SEL Time-Domain Link (TiDL®) and SEL Sampled Values (SV) solutions that advance how you protect and control the primary equipment in your substation.

## Automation

### Automation Services

Proven automation and integration services using SEL technology, including solutions for SCADA, distribution network automation, and renewable energy control.

### MOTORMAX® Low-Voltage Motor Management and Protection System

Centralized motor management system for comprehensive control, protection, analysis, and monitoring in motor control centers (MCCs).

### Metering Services

Metering solutions for both producers and consumers of energy, including custom solutions for electric power, steam, water, or gas applications in new or existing facilities.

## Cybersecurity

### Cybersecurity Solutions

Solutions to improve cyber defense, streamline ongoing management, and respond to incidents.



## POWERMAX® Power Management

### POWERMAX Power Management Solutions

Integrated control systems composed of scalable relay and control hardware, software, and logic processing and designed by SEL experts.

### POWERMAX for Industrial Power Management

Power management and control systems specifically engineered for industries with critical processes that need to stay online, improving power system reliability, personnel safety, and process uptime.

### POWERMAX for Utilities

Custom solutions that maintain power system stability by detecting abnormal conditions and taking automatic corrective actions, including generation and load shedding and reactive compensation.

### POWERMAX for Mobile Microgrids

Solutions that meet the needs of applications requiring mobility or rapid deployment, such as a military forward operating base (FOB) or a disaster relief effort.

### POWERMAX for Garrison Microgrids

Dependable computing and communications, adaptive relaying, cybersecurity, and a TMS-MIL-STD-compliant microgrid controller that is interoperable with all makes and models of generators, inverters, and loads.

### POWERMAX for Commercial Microgrids

Comprehensive control, protection, and metering systems to keep your power system operating when separated from the bulk electric grid.



## General Engineering

### Design and Drafting Services

Full substation design packages, site retrofits for existing electrical gear, and detailed design drawings for power system protection, automation, metering, and control.

### Government Engineering Services

Innovative, technologically advanced power management services and solutions for municipalities and government organizations, including branches of the military, national laboratories, and governmental agencies.

### Engineering Studies and Simulation Services

Hardware-in-the-loop (HIL) testing services, feasibility studies, coordination reports, system stability assessments, and more.

### Custom Panel and Enclosure Solutions

Custom protection, control, and metering panels; control cabinets; and retrofit doors to match your specifications.





## Bookstore

Order online at [selinc.com/bookstore](http://selinc.com/bookstore) 

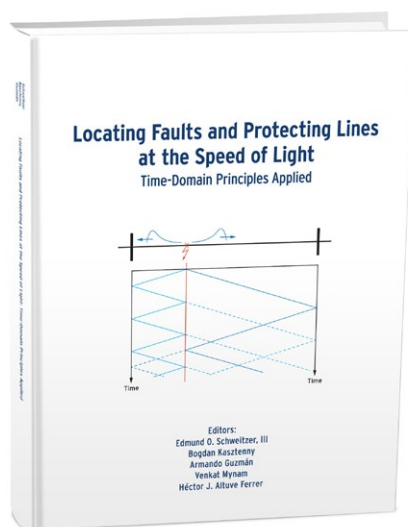
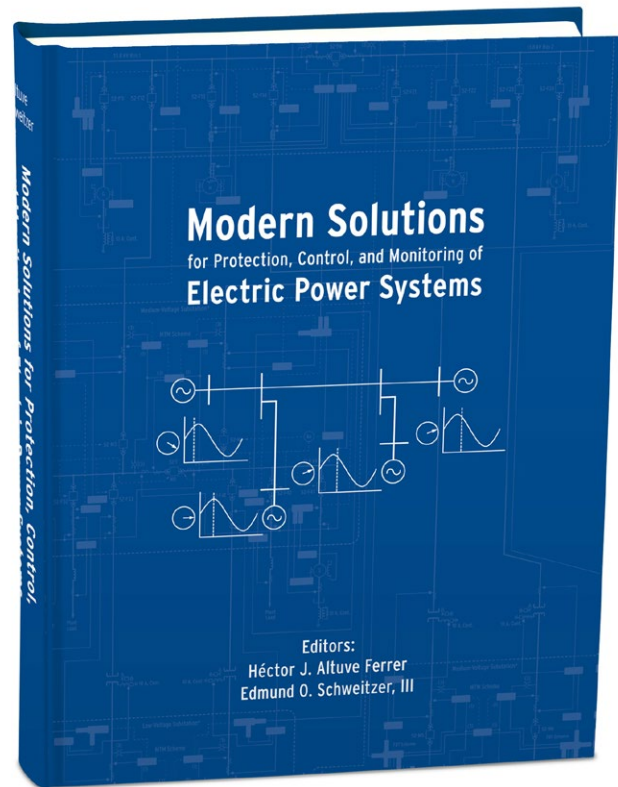
### Modern Solutions for Protection, Control, and Monitoring of Electric Power Systems

The most comprehensive work of its kind, this book consolidates new, modern solutions for protection, control, and monitoring of electric power systems.

You'll find straightforward presentations and example applications of the following technologies:

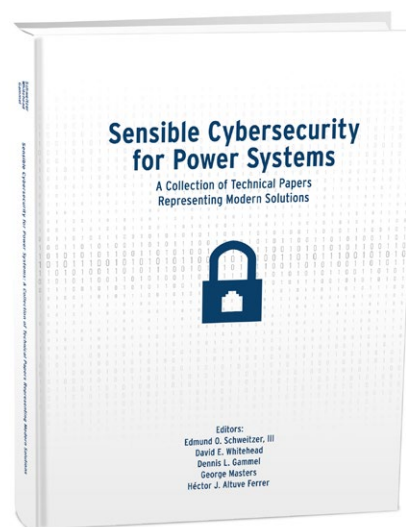
- Time-synchronized protection, control, and monitoring.
- Wide-area protection and control using synchrophasors.
- Sensible cybersecurity and a security-in-depth tool kit.
- Distribution systems that deliver safe operation and rapid power restoration after faults.
- Transmission protection solutions that improve stability, detect power swings, and help you get the most out of your primary equipment.

Spanish version available



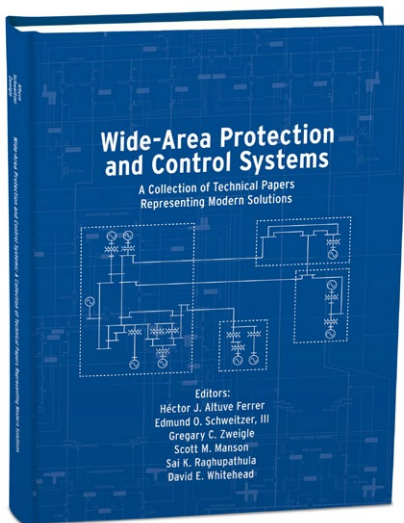
### Locating Faults and Protecting Lines at the Speed of Light

This book, composed of 15 technical papers, explains traveling waves and instantaneous incremental quantities for line protection and fault locating.



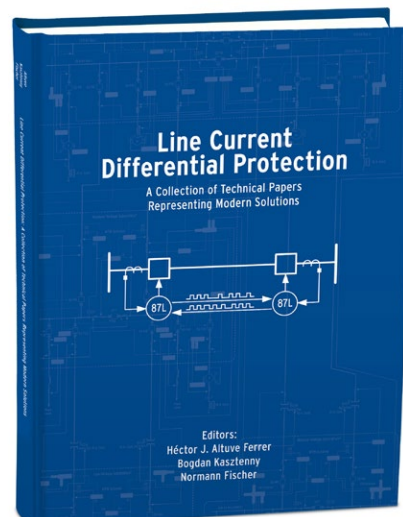
### Sensible Cybersecurity for Power Systems

This book, composed of over 25 technical papers, provides an overview of power system cybersecurity challenges, opportunities, and solutions.



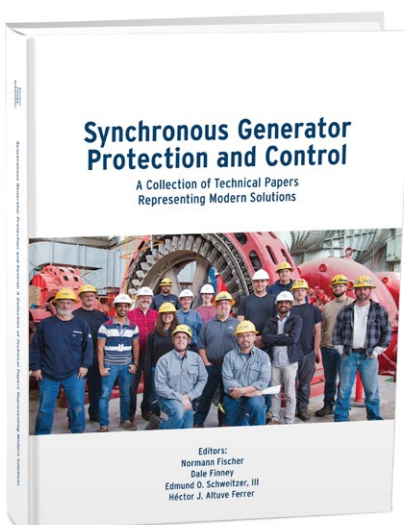
## Wide-Area Protection and Control Systems

This book, composed of 41 technical papers, covers the practical technology and solutions for wide-area protection and control that are in service today.



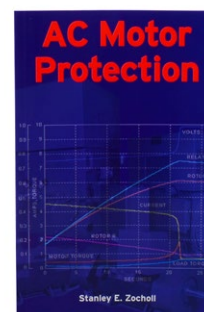
## Line Current Differential Protection

This book, composed of 15 technical papers, addresses the design and application of line current differential protection, communications, and fault locating, from both the protection and communications perspectives.



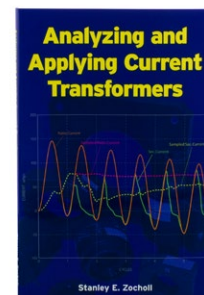
## Synchronous Generator Protection and Control

This book, composed of 27 technical papers, covers modern technologies for synchronous generator protection, control, and monitoring.



## AC Motor Protection

This book, written for the practicing engineer, covers ac motor characteristics and protection principles in a concise and practical way.



## Analyzing and Applying Current Transformers

This concise book explains fundamental concepts for non-linear characteristics, accuracy ratings, and transient behavior of current transformers.



SEL University trains power system professionals in areas ranging from fundamental power system protection principles to hands-on product application and testing. We provide the training you need to make electric power safer, more reliable, and more economical. Our power system experts have trained tens of thousands of industry professionals worldwide. Our instructors are the same industry experts who design SEL equipment and solutions, support customers, and add to the field of knowledge through industry publications.



## Classroom-Based Training

### Scheduled classroom-based courses

With scheduled SEL University courses, you can:

- Learn at convenient locations around the world.
- Receive fundamentals and hands-on training.
- Network with other industry professionals.
- Easily view the course schedule and register online.

### On-site and virtual company training

With our on-site training option, you supply the training room and we provide the equipment, course materials, and instructors. Training can also be delivered virtually using video conferencing software. On-site and virtual training allow you to:

- Choose a standard course or mix and match standard course material to meet your needs.
- Reduce travel expenses and train more employees at one time.
- Address your company's specific training needs in a confidential environment.

## Course Types

### Power system

Power system fundamentals for engineers.

### Protection

Power system protection fundamental principles and applications.

### Communications

Introductory and advanced networking and data communications fundamentals.

### Application

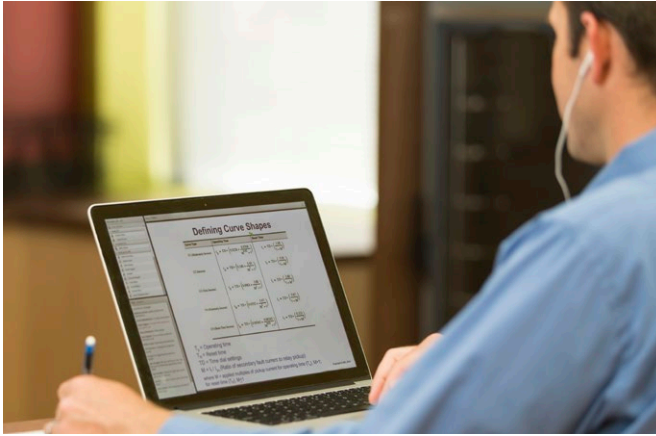
Hands-on settings and applications for SEL products.

### Testing

Hands-on relay testing and troubleshooting.

### Systems

Advanced hands-on integration and design.



## eLearning Courses

SEL University offers several types of eLearning courses that give you flexible training options. These courses act as a supplement or substitute for traditional classroom courses.

### Self-paced training

Access your training content online at any time with our self-paced eLearning courses. From our complimentary overview (CBT 101) to more detailed studies of SEL products and fundamentals, these courses can serve as a foundation or convenient substitute for our in-depth, classroom-based courses.

With SEL University self-paced courses, you can:

- Maximize your training budget.
- Track your eLearning completion status online.
- Earn professional development hours (PDHs) or continuing education units (CEUs).
- Choose an individual or corporate license.

### Live eLearning

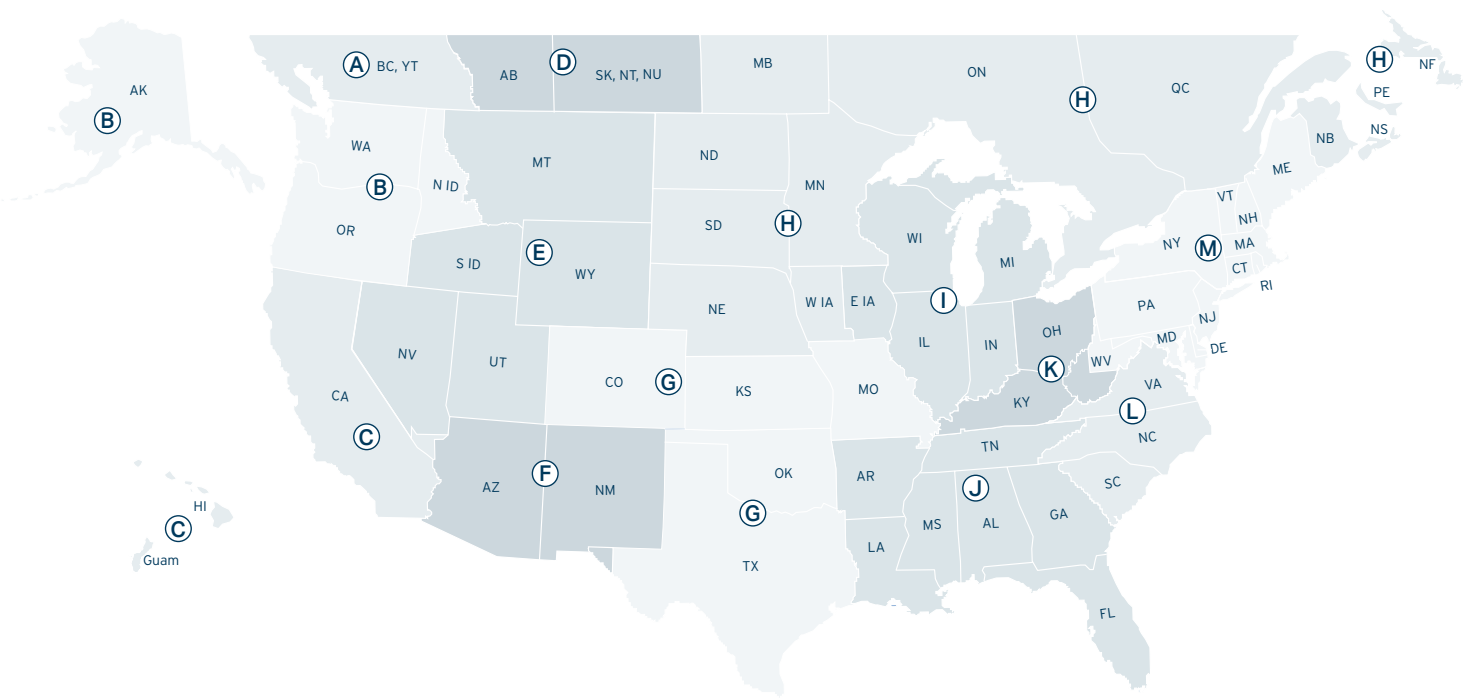
Live eLearning courses are held in real time with scheduled instruction to provide a live training experience without the expense of travel. The topics relate to SEL products and fundamentals.

Live eLearning courses enable you to:

- Maximize your training budget.
- Maintain flexibility in your schedule.
- Attend class from anywhere.
- Ask questions and share ideas with your instructor and your peers.
- Use homework assignments to practice the course material before follow-up discussions.
- Earn PDHs or CEUs.



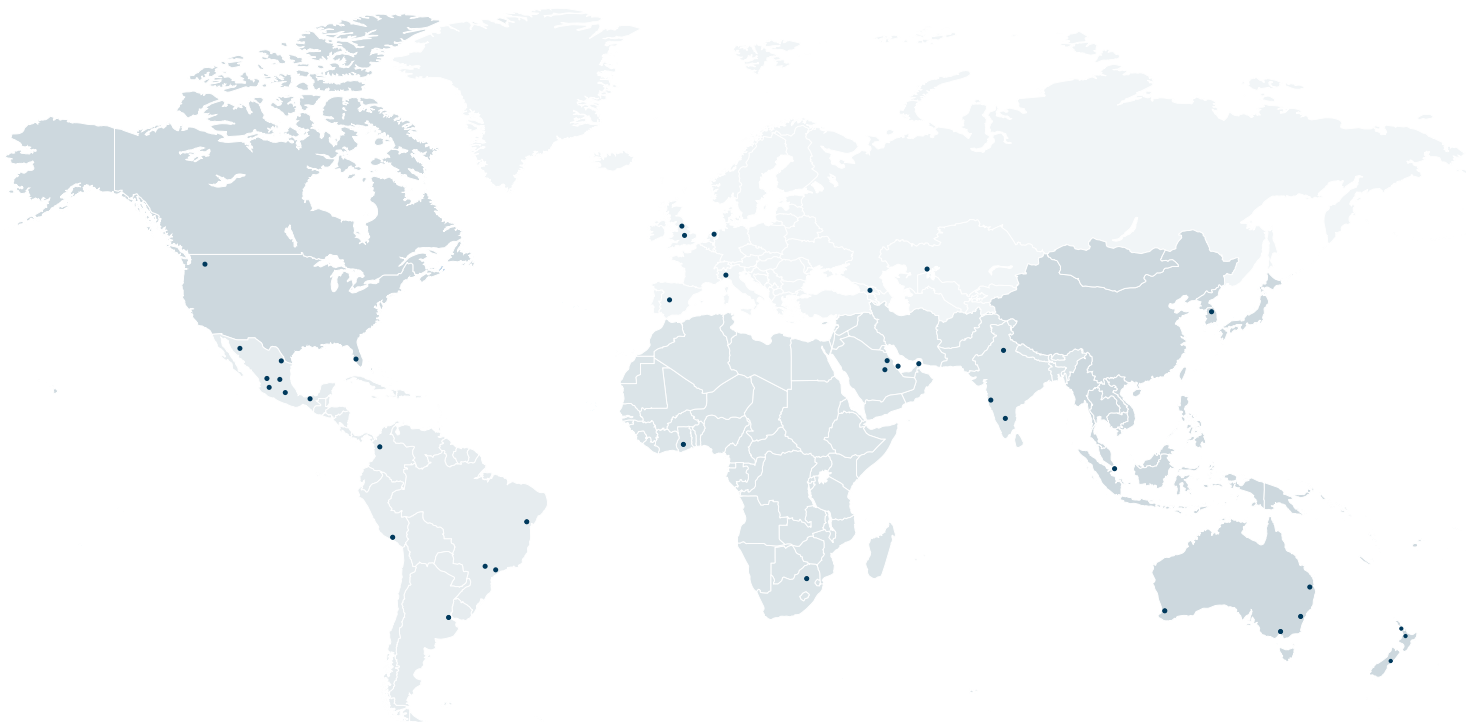
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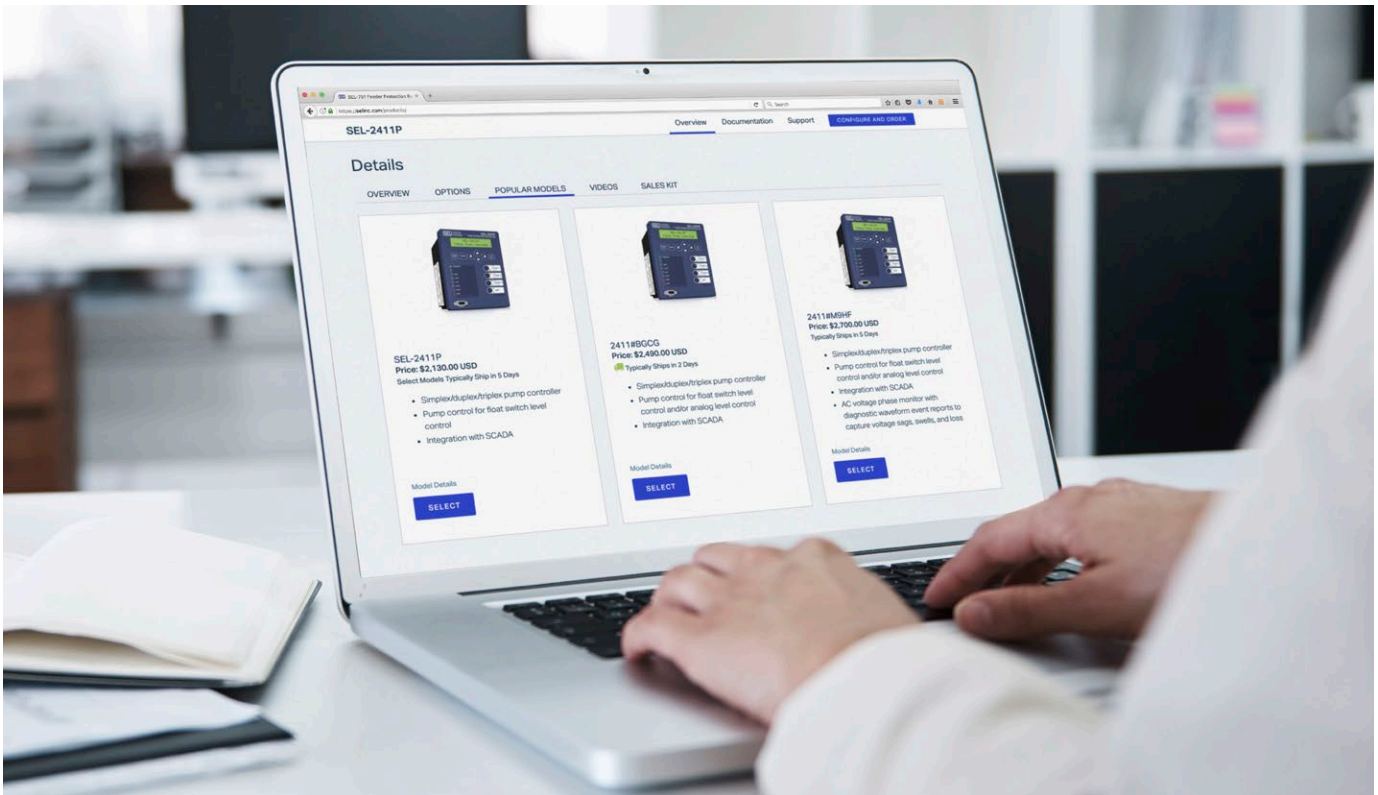
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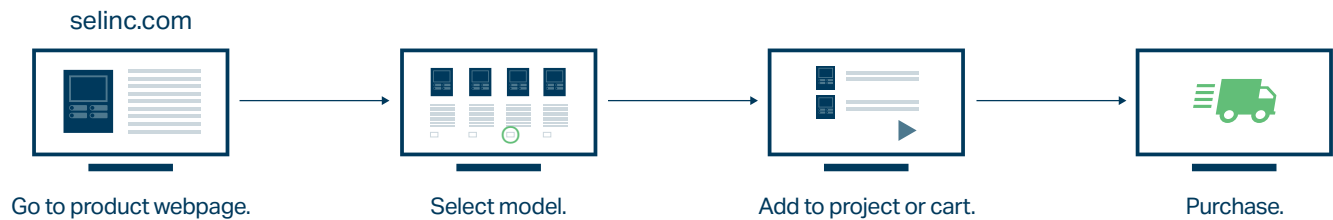


## Popular Models Simplify Ordering



The Popular Models program makes selecting and ordering SEL products simple, fast, and convenient. Through this program, SEL provides preconfigured product models for popular applications. Specific models offer discount pricing and/or ship from stock, typically in 2 business days.





The popular models are displayed on the webpage for the majority of SEL products, and the webpage clearly shows the technical details and popular applications for each model. You can order these models directly online or through your SEL sales representative.



## Example Popular Models for the SEL-2411P Pump Automation Controller

For a complete popular models listing, visit [selinc.com/products/popular](https://selinc.com/products/popular) 

 Select models typically ship in 2 days

| Application Details   | Item No.   | Price       |  |
|---|--|-------------|--|
| Simplex, duplex, and triplex pump control for float switch level control and integration with SCADA.  | 2411#GJ44  | \$2,130 USD |   |
| Simplex, duplex, and triplex pump control for float switch level control and/or analog level control and integration with SCADA.  | 2411#BGCG  | \$2,490 USD |   |
| Simplex, duplex, and triplex pump control for float switch level control and/or analog level control, integration with SCADA, and ac voltage phase monitoring with diagnostic waveform event reports. | 2411#M9HF  | \$2,700 USD |  |



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