SEL-351S
Protection System

Advanced distribution feeder solution with integrated protection, monitoring, and control

- Achieve sensitive and secure fault detection using comprehensive protection functions.
- Keep track of breaker status and help schedule maintenance with enhanced breaker monitoring.
- Enhance operation and simplify panels with large, easy-to-use operator controls and optional independent SafeLock® trip/close pushbuttons.
- Troubleshoot system-wide and local power quality disturbances using voltage sag, swell, and interruption (VSSI) reports.
Functional Overview

ANSI Numbers/Acronyms and Functions

<table>
<thead>
<tr>
<th>Number</th>
<th>Function</th>
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<tbody>
<tr>
<td>16</td>
<td>SEC Access Security (Serial, Ethernet)</td>
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<td>25</td>
<td>Synchronism Check</td>
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<tr>
<td>27</td>
<td>Undervoltage</td>
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<tr>
<td>32</td>
<td>Directional Power*</td>
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<td>50BF</td>
<td>Breaker Failure Overcurrent</td>
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<tr>
<td>50N</td>
<td>Neutral-Ground Overcurrent</td>
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<tr>
<td>50 (P,G,Q)</td>
<td>Overcurrent (Phase, Ground, Neg. Seq.)</td>
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<tr>
<td>51N</td>
<td>Neutral-Ground Time-Overcurrent</td>
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<tr>
<td>51 (P,G,Q)</td>
<td>Time-Overcurrent (Phase, Ground, Neg. Seq.)</td>
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<td>52PB</td>
<td>Trip/Close Pushbuttons*</td>
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<tr>
<td>59 (P,N,Q)</td>
<td>Overvoltage (Phase, Neutral, Neg. Seq.)</td>
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<tr>
<td>67N</td>
<td>Directional Neutral Overcurrent</td>
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<tr>
<td>67 (P,G,Q)</td>
<td>Directional Overcurrent (Phase; Ground, SEF*; Neg. Seq.)</td>
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<td>79</td>
<td>Autoreclosing</td>
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<td>81 (O,U,R)</td>
<td>Frequency (Over, Under, Rate)</td>
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<td>85 RIO</td>
<td>SEL Mirrored Bits* Communications*</td>
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<td>DFR</td>
<td>Event Reports</td>
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<td>HMI</td>
<td>Operator Interface</td>
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<tr>
<td>LGC</td>
<td>SELLogic® Control Equations®</td>
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<td>MET</td>
<td>High-Accuracy Metering</td>
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<tr>
<td>PMU</td>
<td>Synchrophasors</td>
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<td>PQM</td>
<td>Voltage Sag, Swell, and Interruption*</td>
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<tr>
<td>SER</td>
<td>Sequential Events Recorder</td>
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</tbody>
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Additional Functions

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Function</th>
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</thead>
<tbody>
<tr>
<td>BRM</td>
<td>Breaker Wear Monitor</td>
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<tr>
<td>HBL</td>
<td>Harmonic Blocking</td>
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<tr>
<td>LDE</td>
<td>Load Encroachment</td>
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<tr>
<td>LDP</td>
<td>Load Data Profiling*</td>
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<tr>
<td>LOC</td>
<td>Fault Locator</td>
</tr>
<tr>
<td>PPV</td>
<td>Phantom Phase Voltage</td>
</tr>
<tr>
<td>SBM</td>
<td>Station Battery Monitor</td>
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</tbody>
</table>

*Copper or fiber-optic  *Optional feature
Key Features

Complete Distribution System Protection
Protect lines and equipment using phase, negative-sequence, residual-ground, and neutral-ground overcurrent elements with directional control. The SEL-351S Protection System includes many advanced protection features that ensure secure and reliable operation, such as second-harmonic blocking and rate-of-change-of-frequency (ROCOF) controls.

Voltage Sag, Swell, and Interruption (VSSI)
Access power system disturbance information through the optional VSSI recorder for advanced power quality monitoring that allows you to troubleshoot system-wide and local power quality disturbances. The VSSI report captures power quality data related to voltage disturbances over a long period of time, including the magnitude of the currents and voltages, a reference voltage, and the status of the VSSI Relay Word bits.

Advanced Reclosing Capabilities and Sequence Coordination
Use synchronism-check and voltage condition logic to program up to four shots of automatic reclosing with automatic or manual supervision. Sequence coordination logic is built in to synchronize relay protection to downstream recloser operations.

Reliable Breaker Control
Open or close the circuit breaker manually with the optional SafeLock trip/close pushbuttons, which provide direct control of the breaker independent of the relay. Switch contacts and indicating lamps are separately wired to screw-terminal blocks on the rear of the relay, and they are functional even if the relay is out of service. The trip/close pushbuttons are equipped with the SafeLock system to prevent inadvertent operation and facilitate lockout/tagout procedures.
USB port simplifies local connections and speeds up relay communications.

Default displays or programmable custom messages notify personnel of power system events or relay status.
Programmable operator pushbuttons and optional user-configurable labels allow for ease of operation.

Front-panel LEDs can be programmed to indicate custom alarms.

Optional SafeLock® trip/close pushbuttons and bright indicating LEDs allow breaker control independent of the relay.
High-current interrupting output contacts increase contact robustness and reliability.

Harmonic metering to the 16th harmonic enhances power quality analysis.

Sensitive earth fault (SEF) protection accurately detects ground faults with low current values.*

Expanded I/O allows for flexible applications.*

SafeLock® trip/close pushbuttons on the front panel are wired directly to these terminals to allow breaker control independent of the relay.*

Transparent.
Standard multisession Modbus® TCP, Modbus RTU, DNP3, and IEC 61850* provide communications flexibility.

Mirrored Bits® communications provides fast and reliable relay-to-relay communication.

Dual copper Ethernet port allows communication between devices and provides redundancy. Single or dual fiber-optic ports are also available.

Built-in phasor measurement unit allows wide-area power system monitoring.

EIA-485 port provides quick and easy engineering access.

*Optional feature
Applications

Comprehensive Protection Features

Instantaneous and Time-Overcurrent Elements With Second-Harmonic Blocking

- Use multiple instantaneous and time-overcurrent elements with SELoGic control equations to coordinate protection with downstream devices. Best Choice Ground Directional Element® logic optimizes directional element performance and eliminates the need for many directional settings.
- Select from six levels of phase, negative-sequence, residual-ground, and neutral-ground instantaneous overcurrent elements to best fit your application.
- Use the second-harmonic blocking elements to detect transformer energization and block selected tripping elements until inrush conditions subside.

Communications-Assisted Tripping

Communications-assisted tripping schemes provide unit protection for transmission or networked distribution lines. No external coordination devices are required. Built-in scheme logic permits fast trip times, reducing fault durations that adversely impact system loads, power system equipment, and stability.

Apply MIRRORED BITS communications to communications-assisted tripping over traditional communications equipment. A MIRRORED BITS implementation has the advantages of increased reliability using less equipment, increased speed with no contact closure delay, better security through built-in channel monitoring, and reduced wiring complexity.

Flexible Frequency Elements

- Apply six levels of frequency elements to provide multilevel under- and overfrequency protection.
- Improve frequency control with four independent ROCOF elements. Each element includes logic to detect either increasing or decreasing frequency, allowing for control or switching actions, such as network decoupling or load shedding.

Fast Dropout Breaker Failure Element

Detect a failed circuit breaker with built-in breaker failure detection elements and logic. High-speed, open-phase detection logic allows you to set the pickup current below the minimum load for sensitivity without sacrificing high-speed dropout.

Fault Locator

Reduce fault-locating and repair times with the built-in impedance-based fault locator and faulted phase indication. Efficiently dispatch line crews to isolate line problems and restore service faster.

Expanded SELoGic Control Equations

SELogic control equations permit custom programming for traditional and unique protection and control functions. Add these programmable control functions to your protection and automation systems.

Create your own custom applications using powerful SELogic control equations.
**Advanced Communications**

Integration With Ethernet Networks

- Connect the SEL-351S directly to a local network with the built-in Ethernet interface or through an SEL-3530 Real-Time Automation Controller (RTAC).
- Provide seamless failover protection with the Parallel Redundancy Protocol (PRP).
- Use DNP3 LAN/WAN, Modbus® TCP, and IEC 61850 to quickly send information through your networks.
- Increase communications reliability with separate and redundant communications ports.
- Transfer data at high speeds (10 Mbps or 100 Mbps) for fast human-machine interface (HMI) updates and file uploads.

- Use popular Telnet applications for easy terminal communication with SEL relays and other devices.
- Use popular FTP applications for easy transfer of settings, events, and history files.
- Transmit synchrophasor data to multiple clients using UDP and TCP formats.
- Simplify wiring and installation by receiving a time signal over existing Ethernet networks using the Simple Network Time Protocol (SNTP). SNTP makes a good backup to more accurate IRIG-B time synchronization.

**Enhanced Mirrored Bits Communications**

Mirrored Bits communications technology provides bidirectional digital communications between devices. Use Mirrored Bits communications to transmit/receive information between upstream relays and downstream recloser controls to enhance coordination and achieve faster tripping for downstream faults.

SEL offers complete Ethernet direct-connect solutions.

Improve performance with SEL Mirrored Bits communications.
Monitoring and Metering

Enhanced Breaker Monitoring
Inspect reports for the most recent trip and close operating times and average operating times, or gather trending data for up to 128 previous operations. This information allows timely and economical scheduling of breaker maintenance.

Built-In Web Server
Access basic SEL-351S information on a standard Ethernet network with the built-in web server. View relay status, Sequential Events Recorder (SER) data, metering information, and settings through easy access within a local network. Upgrade your firmware remotely through the Ethernet connection. Web server access requires a relay password.

Synchrophasors
To significantly improve your system's performance, SEL offers complete synchrophasor solutions, including hardware, communications, data collection, viewing and analysis software, and data archiving. The SEL-351S provides real-time system state measurement with time-synchronized voltages and currents in the IEEE C37.118 standard format. In addition, SEL-5078-2 SYNCHROAVe® Central Visualization and Analysis Software or third-party software allow you to view and analyze system phase angles, load oscillations, voltage profiles, and other critical system information.
Easy to Set and Use

Implement Digitally Signed Firmware Upgrades
- The cryptographically secure signature ensures that the file has been provided by SEL and that its contents have not been altered.
- If the SEL-351S cannot verify the signature, it rejects the corrupted or altered firmware file.

Use QuickSet to Set, Monitor, and Control the SEL-351S
- Save engineering time while maintaining flexibility. Communicate with the SEL-351S through terminal software, or use the QuickSet graphical user interface.
- Develop settings offline with a menu-driven interface and completely documented help screens. Speed up installation by copying existing settings files and modifying application-specific items.
- Simplify the setting procedure with a rules-based architecture to automatically check interrelated settings. Out-of-range or conflicting settings are highlighted for correction.
- Streamline the configuration of IEC 61850-enabled relays with AcSELerator Architect® SEL-5032 Software.
- View COMTRADE files from the SEL-351S and other digital fault recorders with SEL-5601-2015 SYNCHROVAVE Event 2015 Software.

Store Design Templates
- Store any number of files inside one compressed file up to 750 kilobytes, including AcSELerator QuickSet® SEL-5030 Software settings files, a QuickSet relay database containing a design template, or other files of your choice.
- QuickSet automatically verifies that settings match the design template upon retrieving the template from the relay.

- QuickSet design template.
- QuickSet settings form view and AcSELerator® event report.
# SEL-351S Specifications

## General

| **AC Current Inputs** | IA, IB, and IC: 5 A or 1 A nominal  
|                      | IN: 5 A, 1 A, 0.2 A, or 0.05 A nominal |
| **AC Voltage Inputs** | 300 V maximum |
| **Output Contact Ratings** | Standard Output Contacts  
|                      | Make: 30 A  
|                      | Carry: 6 A continuous carry at +70°C  
|                      | Breaking capacity: 0.20—0.75 A (depending on voltage) |
|                      | High-Current Interrupting Output Contacts  
|                      | Make: 30 A  
|                      | Carry: 6 A continuous carry at +70°C  
|                      | Breaking capacity: 10 A |
| **Frequency and Phase Rotation** | 60/50 Hz system frequency  
|                      | ABC or ACB phase rotation |
| **Communications Ports** | EIA-232 (3 ports)  
|                      | USB Type B  
|                      | EIA-485  
|                      | Fiber-optic multimode ST® serial port (optional)  
|                      | Ethernet port:  
|                      | Dual 10/100BASE-T (RJ-45 connector)  
|                      | Single 100BASE-FX (LC connector) (optional)  
|                      | Dual 100BASE-FX (LC connector) (optional)  
|                      | Single 10/100BASE-T (RJ-45 connector) and single 100BASE-FX (LC connector) (optional) |
| **Communications Protocols** | SEL, IEC 61850 (optional), Mirrored Bits communications (optional), Modbus, DNP3, ASCII protocols, SNTP, IEEE C37.118 (synchrophasors), built-in web server, FTP, PRP (optional), Telnet |
| **Synchrophasors (IEEE C37.118 Standard)** | Up to 50 messages per second (50 Hz system)  
|                      | Up to 60 messages per second (60 Hz system) |
| **Processing** | AC voltage and current inputs: 128 samples per cycle, 3 dB low-pass filter cut-off frequency of 3 kHz  
|                      | Digital filtering: Full-cycle cosine filters after low-pass analog and digital filtering  
|                      | Protection and control processing: 4 times per power system cycle |
| **Power Supply** | 125/250 Vdc or 120/230 Vac  
|                      | Range: 85–350 Vdc or 85–264 Vac  
|                      | 48/125 Vdc or 120 Vac  
|                      | Range: 38–200 Vdc or 85–140 Vac  
|                      | 24/48 Vdc  
|                      | Range: 18–60 Vdc |
| **Operating Temperature** | −40° to +85°C (−40° to +185°F) |