SEL-2431
Voltage Regulator Control

Improve Efficiency, and Optimize System Voltage

• Standardize with a single control to simplify installation, reduce training, and minimize operator errors.
• Transfer settings, firmware, and operational data easily via the front-panel USB port.
• Choose standalone programmable operation or integrate with communications and control systems to improve system efficiency.
• Configure different modes of operation to support bidirectional current flow and provide voltage regulation in Automatic Network Reconfiguration schemes.
Key Features

Plug-In Voltage Regulator Compatibility
The SEL-2431 can be used with many different voltage regulators, including Cooper, GE, Howard Industries, Siemens, and Toshiba 32-step single-phase voltage regulators.

- Siemens/Allis-Chalmers or Howard Industries Type A with both a source- and a load-side PT.
- Siemens/Allis-Chalmers Type A single-phase voltage regulator with only a source-side PT.
- General Electric or Cooper/McGraw Edison Type A.
- Siemens/Allis-Chalmers, GE, Howard Industries, Cooper/McGraw Edison, or Toshiba CR-3 Type B.

Built-In Reliability, Ten-Year Warranty
Reduce maintenance and repair costs with a voltage regulator control designed and tested to relay standards. Mounted in a rugged cast-aluminum housing, the SEL-2431 Voltage Regulator Control includes the SEL worldwide, ten-year, no-questions-asked warranty.

Easy Application Settings
Accelerate installation and commissioning with application-specific settings. Regulate voltage while applying advanced metering and event-recording capabilities with fewer than 20 settings.

Simple and Flexible Communications
Quickly integrate the SEL-2431 into Ethernet or serial communications networks with DNP3, SEL, and synchrophasor protocols. Both the serial and Ethernet ports are available with copper and fiber-optic connection options.

Quickly Retrieve Data
Event reports, tap change history, load profile data, and Sequential Events Recorder (SER) data are all available through the USB port or other communications interfaces. You may also use a USB flash drive to quickly transfer settings, upgrade firmware, and expand onboard storage capacity.
Applications

Optimize System Voltage
Control the system voltage with directional voltage profiles and detailed tap change event reports.

Install Into Multiple Power System Types
Apply locked-forward, locked-reverse, idle-reverse, bidirectional, or cogeneration operating modes.

Track Tap Position Accurately
Know your tap position with the SEL-2431. Monitor the motor current and holding switch status for accurate tap position tracking.

Monitor Motor Current
Monitor and troubleshoot your voltage regulator with recorded tap change motor current waveforms. The SEL-2431 monitors and records the motor current and lets you quickly review and analyze tap-change waveform reports for better visibility into the condition of your voltage regulator.

Operate in Harsh Environments
Rely on the SEL-2431 for control applications, even in harsh environments. SEL designs and tests the SEL-2431 to meet and exceed utility industry requirements. An operating temperature range of –40° to +85°C (–40° to +185°F) and optional conformal coating mean this control will provide years of reliable service.

Easily Monitor Your Network
Identify the connected phase of downstream voltage regulators by coordinating with synchrophasor measurements in the substation. Access system values for wide-area monitoring and control using IEEE C37.118 synchrophasors, available at up to 60 messages per second. Detect a potential cascading voltage collapse before it happens.

Connect to Your Distribution Automation System
With SEL’s DNA® (Distribution Network Automation) solution or when using another volt/VAR control, the SEL-2431 integrates seamlessly into your system. The SEL-2431 is ideal for centralized and distributed intelligent control for volt/VAR optimization. Integrated SELogic® device control capability adds flexibility for custom and advanced control applications.
Product Overview

Neutral Position Indicator

USB Flash Drive Port

Simple Menu Navigation

System Status Indicators

Ethernet Link Indication

Internal/External Power Switch

Configurable Display Points

Seven Configurable Pushbuttons and LEDs

Drag Hand Reset

Raise/Lower Pushbuttons or Toggle Switch

Separate Fuses to Protect the Controller and the Motor Operator
Optional "Snap-In" Communications Cards
Serial Communications Port
Chassis Ground
Connectorized I/O
Dual Ethernet Communications Ports
Voltage Input
Current Input
Voltage Regulator Interface
Flexible Communications

Dual Ethernet Connectivity
Eliminate the need for a local Ethernet switch device with the built-in switched dual Ethernet ports that integrate the SEL-2431 into fiber or copper networks. Simultaneously support several DNP3 sessions, a Telnet session for engineering access, and a synchrophasor session.

Serial Communications Configurations
The SEL-2431 supports both star and daisy-chain communications configurations. In a star configuration, the information processor or remote terminal unit (RTU) connects directly to each SEL-2431. In the event that one fiber-optic cable is damaged, communication is retained with the remaining voltage regulator controls.

In daisy-chain communications configurations with the fiber-optic communications card accessory in “echo” mode, the control automatically forwards messages from the information processor to the next control. Responses are echoed in similar fashion back to the information processor. Reduce equipment costs and communicate to multiple voltage regulator controls through one serial port.

Stay Connected to Your System, Even Without a Network
In addition to voltage regulator control, use the SEL-2431 to capture system events through oscillography, profile the load, trend the tap history, and provide other system information. Quickly retrieve data using the USB flash drive when a network connection is unavailable.

Oscillographic event reports and load profile reports provide valuable information about the condition of your system. Tap history, motor current oscillography, and Sequence of Events (SOE) reports contain valuable data about the state of your voltage regulator. Together, these data enable you to stay connected for troubleshooting, analysis, and planning.
Application Overview

Creating the Optimum Profile
Apply the SEL-2431 to your single-phase voltage regulators to optimize your voltage profile both now and in the future. After initial construction, feeder load growth causes drastic, unplanned voltage deviations. Single-phase voltage regulators installed at the midpoint or cascaded throughout the feeder can dramatically flatten the voltage profile.

Available Retrofit Kits
Quickly upgrade existing voltage regulator controls with the SEL-2431 direct replacement mounting and wiring kits. These kits provide all the parts needed to easily replace existing controls with the SEL-2431.

Modes of Operation
Program the SEL-2431 quickly and easily for your application-specific installation. With configurable modes of operation, you can apply the SEL-2431 in locked-forward, locked-reverse, bidirectional, idle-reverse, or cogeneration modes.

For example, for systems configured with traditional radial feeders, use the locked-forward mode. For looped systems where current can flow in either direction, use the bidirectional mode where voltage regulation settings can dynamically change based on direction of current.

<table>
<thead>
<tr>
<th>Mode of Operation</th>
<th>Reverse Current</th>
<th>Forward Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Locked Forward</td>
<td>Operation Inhibited</td>
<td>Forward Operation</td>
</tr>
<tr>
<td>Locked Reverse</td>
<td>Reverse Operation</td>
<td>Operation Inhibited</td>
</tr>
<tr>
<td>Bidirectional</td>
<td>Reverse Operation</td>
<td>Operation Inhibited</td>
</tr>
<tr>
<td>Idle Reverse</td>
<td>Operation Inhibited</td>
<td>Forward Operation</td>
</tr>
<tr>
<td>Cogeneration</td>
<td>Forward Operation (Reverse LDC)</td>
<td>Operation Inhibited</td>
</tr>
</tbody>
</table>

Choose the mode of operation that meets your needs.

Programming Made Easy
Use powerful acSELErator QuickSet® SEL-5030 Software to quickly and easily program the SEL-2431. Compatibility with QuickSet makes traditional regulator applications requiring limited settings quick and easy to commission and service. Hide common or unused settings, and further simplify the commissioning process.

Install easily with complete retrofit kits.
## Specifications

<table>
<thead>
<tr>
<th>General</th>
<th>Operating Temperature</th>
<th>–40° to +85°C (–40° to +185°F)</th>
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</thead>
<tbody>
<tr>
<td><strong>Power Supply</strong></td>
<td>120 Vac</td>
<td>Range: 88–132 Vac</td>
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<td></td>
<td></td>
<td>Burden: ≤35 VA</td>
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<td></td>
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<td>Interruption: ≤50 ms at 120 Vac per IEC 60255-11</td>
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<tr>
<td></td>
<td>120 Vac Whetting Source</td>
<td>Range: 88–132 Vac</td>
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<tr>
<td></td>
<td></td>
<td>Rated current: 6 A (motor fuse)</td>
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<tr>
<td></td>
<td>12 Vdc Auxiliary Output Source</td>
<td>Range: 11–14 Vdc</td>
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<tr>
<td></td>
<td></td>
<td>Output power: 6 W at 12 Vdc</td>
</tr>
<tr>
<td><strong>Metering Accuracy</strong></td>
<td>Load current: ±0.3% ±500 μA (0.001–2.000 A) and 0.5° (0.020–2.000 A)</td>
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<tr>
<td></td>
<td>Harmonics (2nd–15th) for current: ±5% of fundamental (0.02–0.64 A)</td>
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<td></td>
<td>Voltages: ±0.3% and ±0.5° (80–145 Vac)</td>
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<tr>
<td><strong>Synchrophasor Accuracy</strong></td>
<td>Maximum data rate in messages per second (IEEE C37.118 protocol): 60 (nominal 60 Hz system); 50 (nominal 50 Hz system)</td>
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<td></td>
<td>IEEE C37.118 accuracy: Level 1 at maximum message rate when frequency-based phasor compensation is enabled</td>
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<tr>
<td></td>
<td>Nominal current: 450 mA</td>
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<td></td>
<td>Current range: 45 to 540 mA</td>
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<td>Frequency range: ±5 Hz of nominal (50 to 60 Hz)</td>
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<td></td>
<td>Voltage range: 80 to 145 V (Voltage range is limited by power supply ratings.)</td>
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<tr>
<td></td>
<td>Phase angle range: –180° to +180°</td>
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