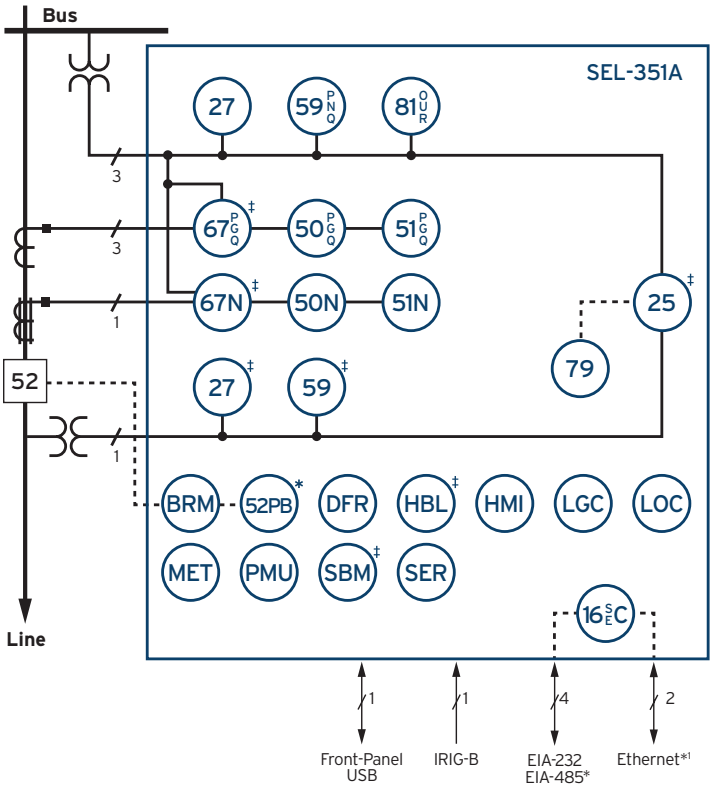
SEL-351A

Protection System

A low-cost, economical solution for distribution feeder protection

- Achieve sensitive and secure fault detection using comprehensive protection functions.
- Track breaker status and schedule maintenance based on enhanced breaker monitoring.
- Enhance operation and simplify panels with optional independent SafeLock® trip/close pushbuttons.

Functional Overview



ANSI Numbers/Acronyms and Functions

16 SEC	Access Security (Serial, Ethernet)
25	Synchronism Check‡
27	Undervoltage
50N	Neutral-Ground Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground,‡ Neg. Seq.)
51N	Neutral-Ground Time-Overcurrent
51 (P,G,Q)	Time-Overcurrent (Phase, Ground, Neg. Seq.)
52PB	Trip/Close Pushbuttons*
59 (P,N,Q)	Overvoltage (Phase, Neutral, Neg. Seq.)
67N	Directional Neutral Overcurrent‡
67 (P,G,Q)	Directional Overcurrent (Phase; Ground, SEF;* Neg. Seq.)
79	Autoreclosing
81 (O,U,R)	Frequency (Over, Under, Rate)
DFR	Event Reports
HMI	Operator Interface
LGC	SELOGIC® Control Equations
MET	High-Accuracy Metering
PMU	Synchrophasors
SER	Sequential Events Recorder

Additional Functions

BRM	Breaker Wear Monitor
HBL	Harmonic Blocking‡
LDE	Load Encroachment‡
LOC	Fault Locator
PPV	Phantom Phase Voltage‡
SBM	Station Battery Monitor

[1] Copper or fiber-optic *Optional feature
‡ Available on the SEL-351A-0

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-351A 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.

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.

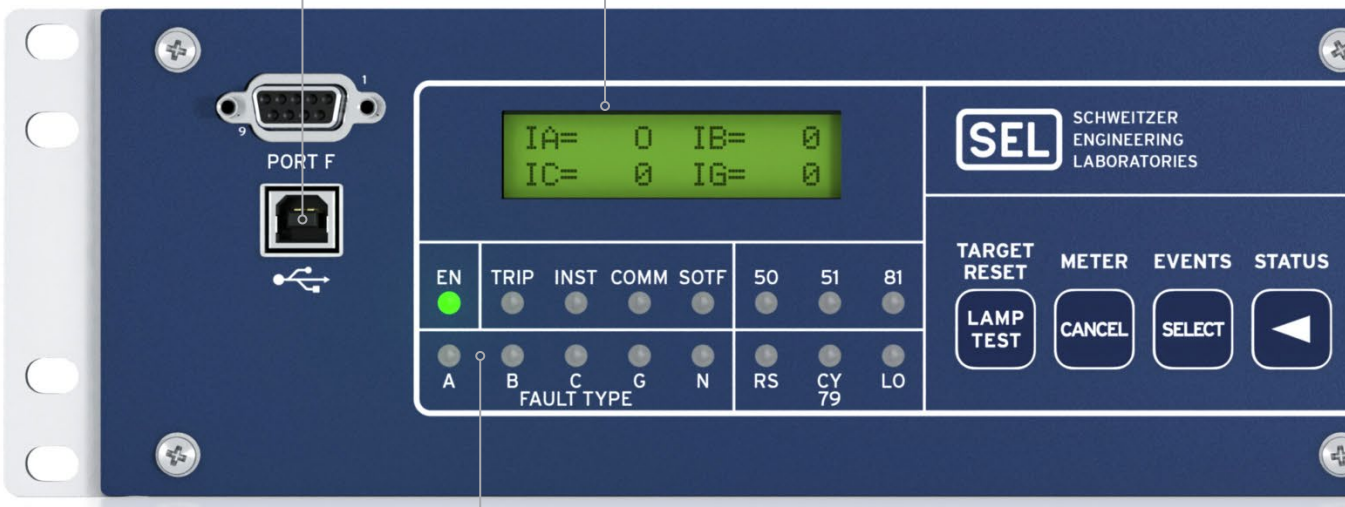
Reliable Breaker Control

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.

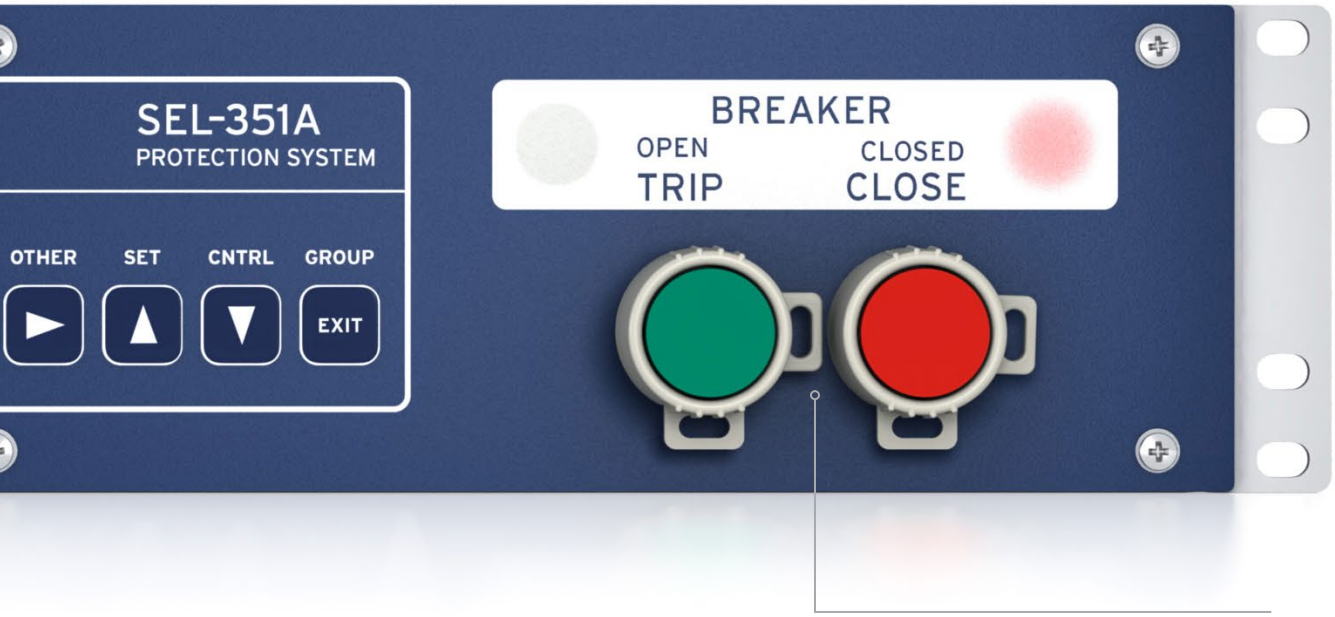
Product Overview

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.



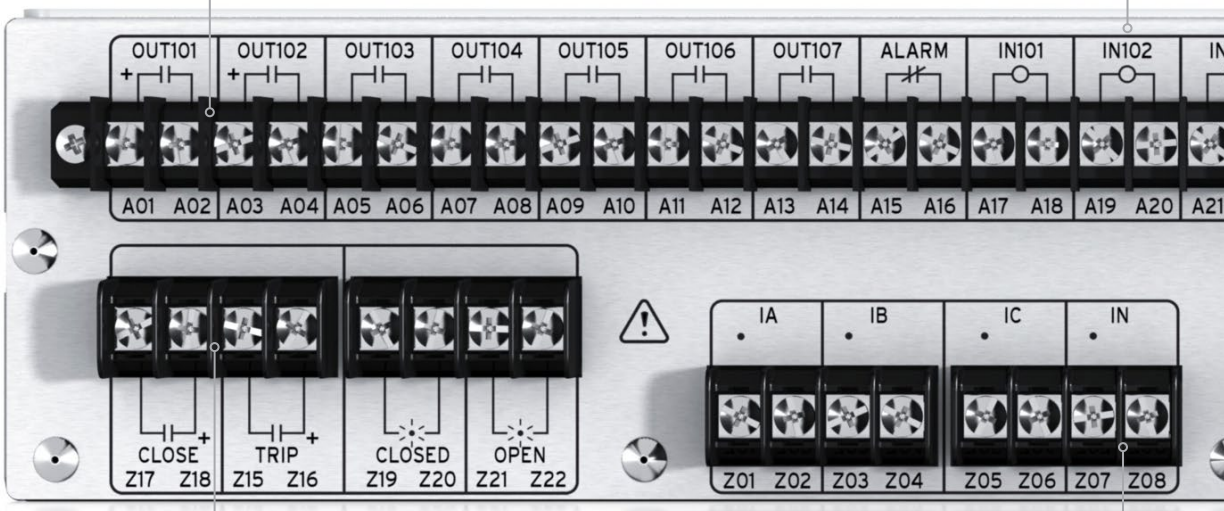
Front-panel LEDs alert operators in the substation to faulted phases, the relay's status, and element operation.



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.

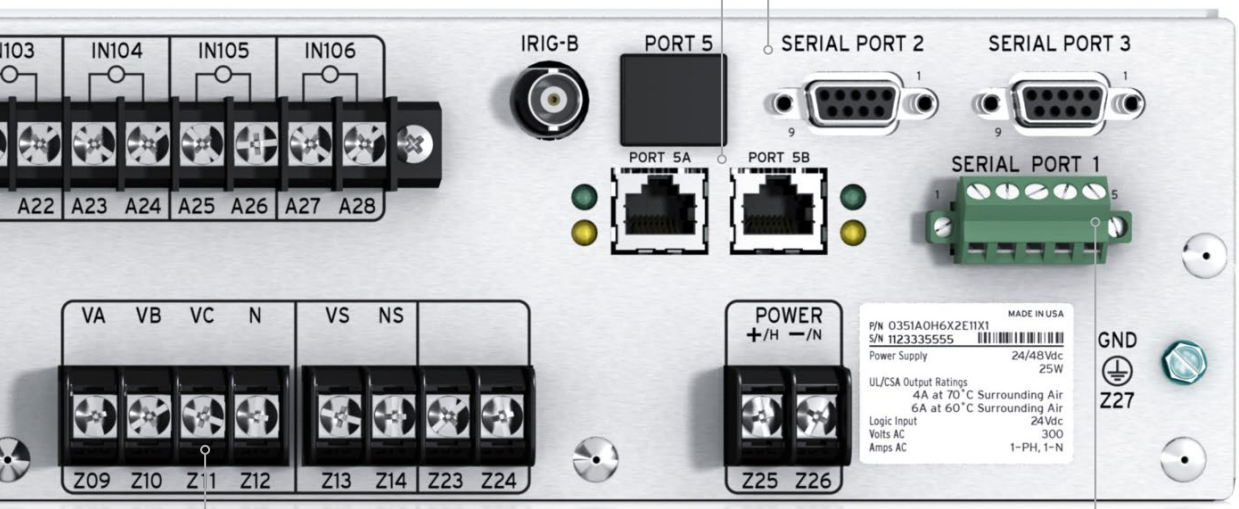


SafeLock® trip/close pushbuttons on the front panel are wired directly to these terminals to allow breaker control independent of the relay.*

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

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

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



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

EIA-485 port provides quick and easy engineering access.

*Optional feature

Applications

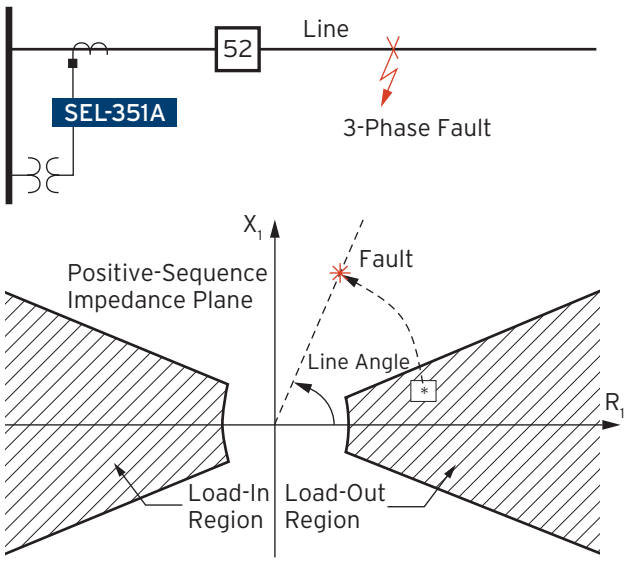
Comprehensive Protection Features

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.

Increased Security With Load Encroachment

Load-encroachment logic allows you to set phase overcurrent elements below the peak load current to see end-of-line phase faults on heavily loaded feeder applications. When the measured positive-sequence load impedance is in a region defined by the load-encroachment logic settings, this logic blocks the phase overcurrent elements. When a phase fault occurs, the positive-sequence load impedance measured indicates a fault condition and allows the phase overcurrent elements to operate.



SEL-351A impedance plane showing a fault condition.

Flexible Frequency Elements

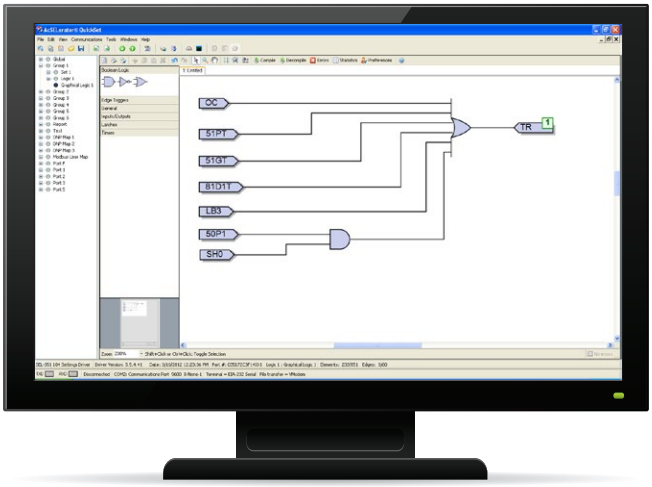
- Apply six levels of frequency elements to provide multilevel under- and overfrequency protection.
- Improve frequency control with four independent ROCOF elements. Each element includes logic to detect either increasing or decreasing frequency, allowing for control or switching actions, such as network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

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.



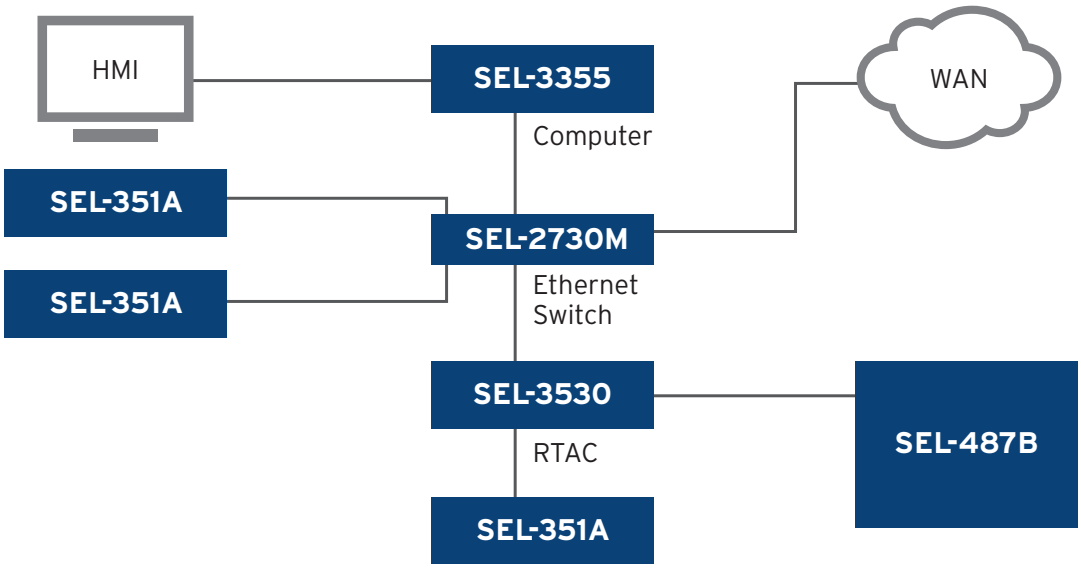
Operator Type	Operators
Boolean	+, *, !
Edge detection	/, \
Precedence control	()

Create your own custom applications using powerful SELOGIC control equations.

Advanced Automation and Communications

Integration With Ethernet Networks

- Connect the SEL-351A 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.



SEL offers complete Ethernet direct-connect solutions.

Monitoring and Metering

Enhanced Breaker Monitoring

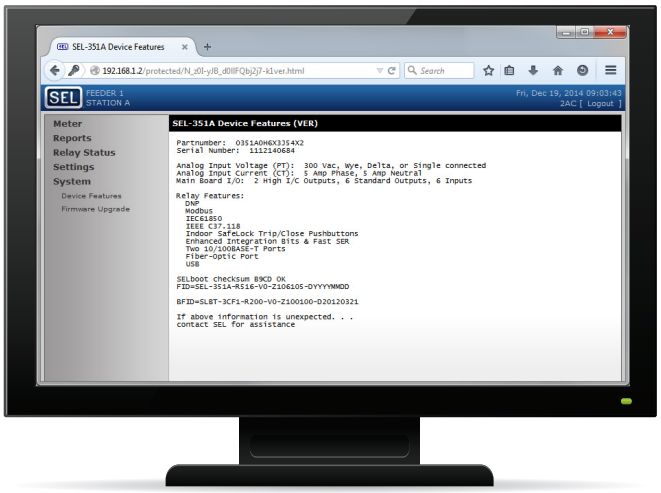
Inspect reports for the most recent trip and close operating times and average operating times, or gather trending data for up to 128 previous operations. This information allows timely and economical scheduling of breaker maintenance.

Built-In Web Server

Access basic SEL-351A 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-351A provides real-time system state measurement with time-synchronized voltages and currents in the IEEE C37.118 standard format. In addition, SEL-5078-2 SYNCHROWAVE® Central Visualization and Analysis Software or third-party software allow you to view and analyze system phase angles, load oscillations, and other critical system information.



Web server menu screen.

Real-time SYNCHROWAVE Central data.

Easy to Set and Use

Implement Digitally Signed Firmware Upgrades

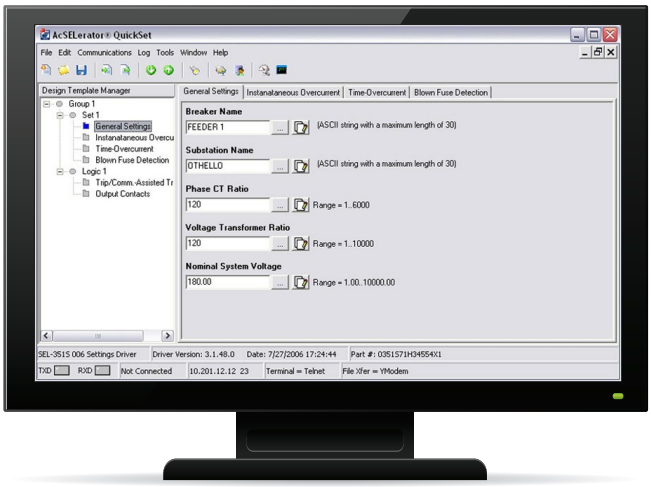
- The cryptographically secure signature ensures that the file has been provided by SEL and that its contents have not been altered.
- If the SEL-351A cannot verify the signature, it rejects the corrupted or altered firmware file.

Store Design Templates

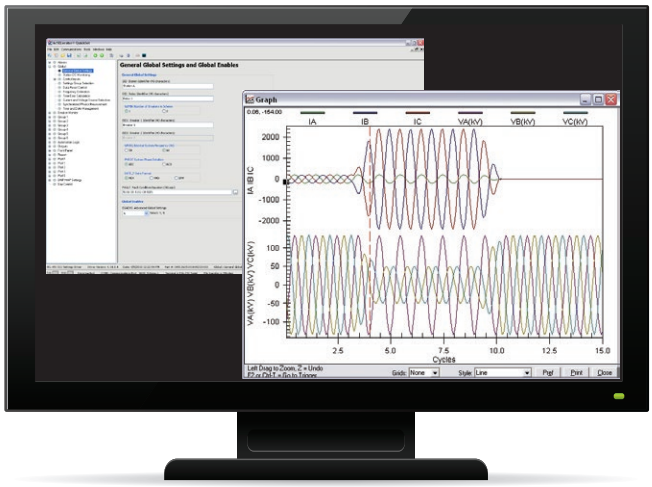
- Store any number of files inside one compressed file up to 750 kilobytes, including ACSELERATOR QuickSet® SEL-5030 Software settings files, a QuickSet relay database containing a design template, or other files of your choice.
- QuickSet automatically verifies that settings match the design template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

Use QuickSet to Set, Monitor, and Control the SEL-351A

- Save engineering time while maintaining flexibility. Communicate with the SEL-351A 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-351A and other digital fault recorders with SEL-5601-2 SYNCHROWAVE Event Software.



QuickSet design template.



QuickSet settings form view and ACSELERATOR® event report.

SEL-351A 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 Ethernet port: Dual 10/100BASE-T (RJ-45 connector) Single 100BASE-FX (LC connector) (optional) Dual 100BASE-FX (LC connector) (optional)
Communications Protocols	SEL, IEC 61850 (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)

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