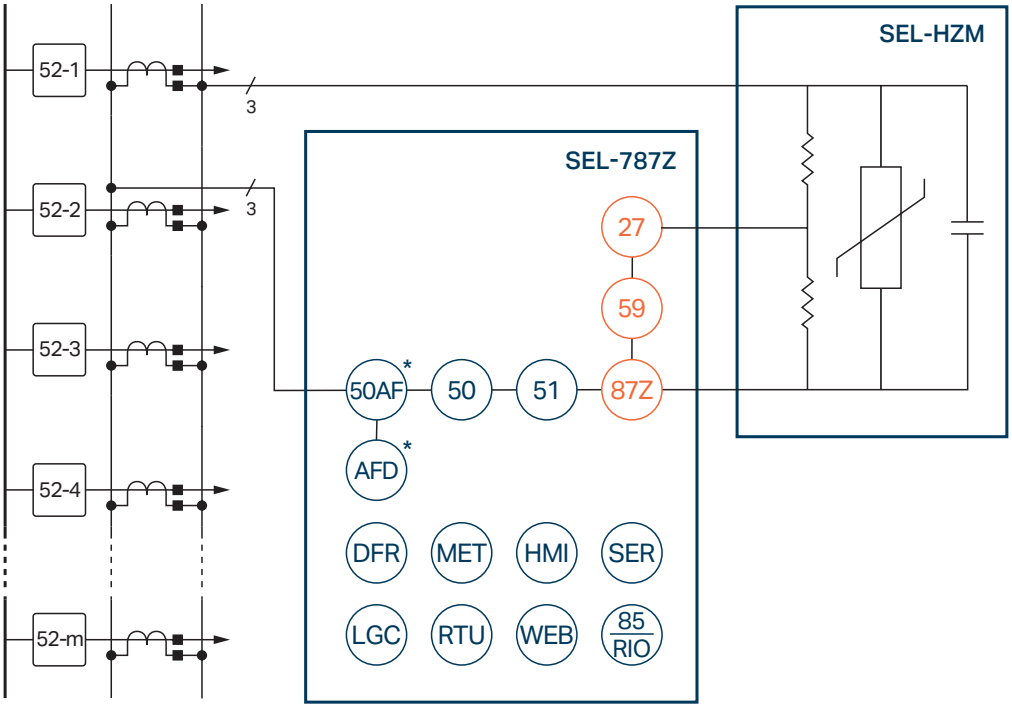
SEL-787Z

High-Impedance Differential Relay

Comprehensive protection and monitoring for high-impedance applications

- Combine the SEL-787Z with the SEL-HZM High-Impedance Module to provide high-speed, economical bus protection with a three-phase high-impedance differential zone.
- Apply the SEL-787Z and SEL-HZM for single-zone bus protection, motor protection, or sensitive restricted earth fault (REF) protection on grounded, wye-connected power transformer windings.
- Protect the CT wiring and relay against high-voltage surges during in-zone faults with built-in metal-oxide varistors (MOVs) in the SEL-HZM.
- Easily integrate the SEL-787Z into your system using Ethernet connections that support IEC 61850 Edition 2, DNP3, EtherNet/IP, and Modbus protocols.
- Configure settings and view relay data using the optional 5-inch color touchscreen, which supports English or Spanish language interfaces.

Overview



ANSI Functions	
27	Definite-Time Undervoltage
50	Overcurrent
50AF	Arc-Flash Overcurrent*
51	Time-Overcurrent
59	Definite-Time Overvoltage
87Z	High-Impedance Differential

Additional Functions	
85RIO	SEL Mirrored Bits® Communications
AFD	Arc-Flash Detection*
DFR	Event Reports
HMI	Human-Machine Interface
LGC	SELogic® Control Equations
MET	High-Accuracy Metering
RTU	Remote Terminal Unit
SER	Sequential Events Recorder
WEB	Web Server

*Optional feature

Key Features

High-Impedance Differential Protection

Apply the SEL-787Z for high-impedance bus protection, motor protection, or restricted earth fault (REF) applications on transformers with grounded-wye windings. Three resistor options (500 Ω, 1,000 Ω, or 2,000 Ω) in the SEL-HZM provide security against CT saturation during through faults. A 7.8 kJ, energy-clamping MOV in the SEL-787Z limits voltage across the stabilizing resistor during bus faults.

Flexible Mounting and Installation Options

The separate SEL-787Z and SEL-HZM offer flexibility in mounting options for device installation. Save time and optimize installation using a prewired rack-mount configuration.

Integrated Web Server

Use the integrated web server and a web browser to access read-only settings information, verify self-test status, inspect metering data, download event reports, and upload firmware. Multilevel password protection separates access to read-only data and settings from interfaces used to upgrade device firmware.

Flexible Communications

Simplify interconnections using protocols like IEC 61850 Edition 2, DNP3, Modbus, IEC 60870-5-103, and EtherNet/IP. Use communications protocols for remote device management, including downloading event reports, upgrading firmware, and resetting the relay. Digital communications replace traditional control panel switches, RTU-to-relay wiring, traditional latching relays, and traditional indicator lights.

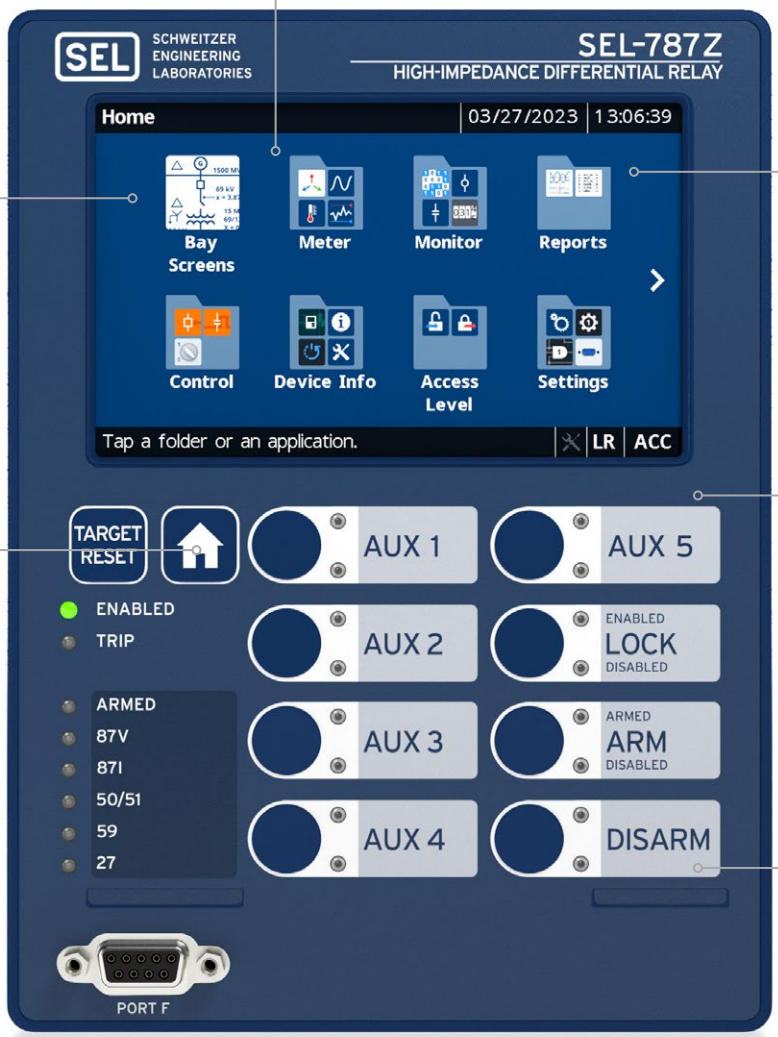
High-Resolution Event Records

Increase system visibility and simplify maintenance schemes with high-resolution event records containing 40 data samples per cycle at 60 Hz (48 data samples per cycle for 50 Hz applications). Use these records to help simplify root cause analysis.

5-Inch Color Touchscreen Display

Access metering data, view event records, control relay operations, edit settings, and more without a laptop. The SEL-787Z touchscreen can be configured to display an English or Spanish language interface. The color touchscreen clearly indicates breaker and primary equipment status, improving safety during maintenance operations.

Touchscreen Overview



5-inch, 800 × 480 display offers direct navigation via a capacitive touchscreen.

A full onscreen keyboard facilitates easy adjustment of settings.

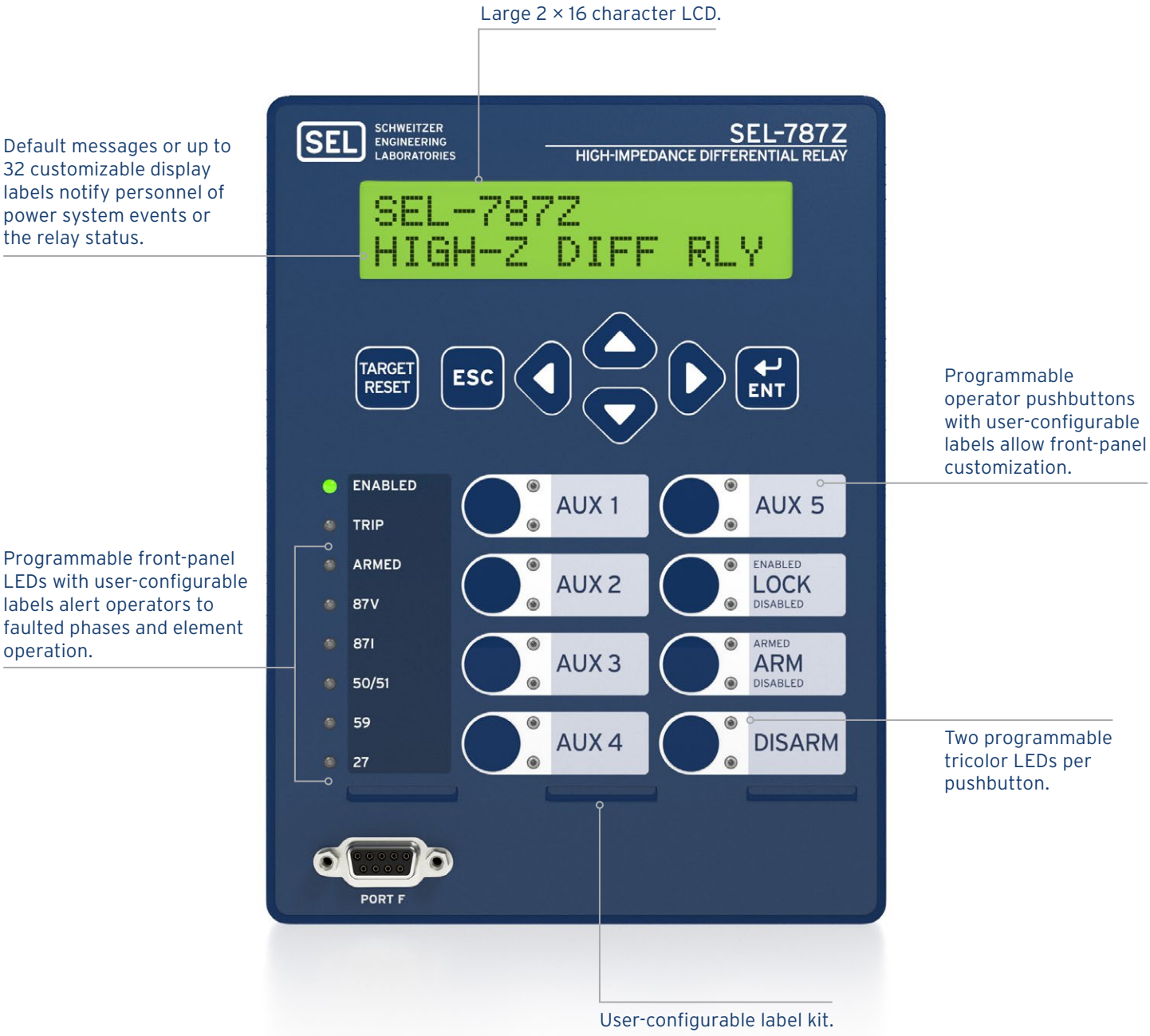
Folders and applications provide quick access to bay screens, metering and monitoring data, reports, settings, and more.

The home pushbutton allows users to easily return to the default home screen.

The front panel is available in English or Spanish.

Programmable operator pushbuttons with user-configurable labels allow front-panel customization.

LCD Overview



SEL-787Z Rear Overview

Power supply options include 110—250 Vdc/110—240 Vac or 24—48 Vdc.

A variety of communications protocols and media provide flexibility to communicate with other devices and control systems.

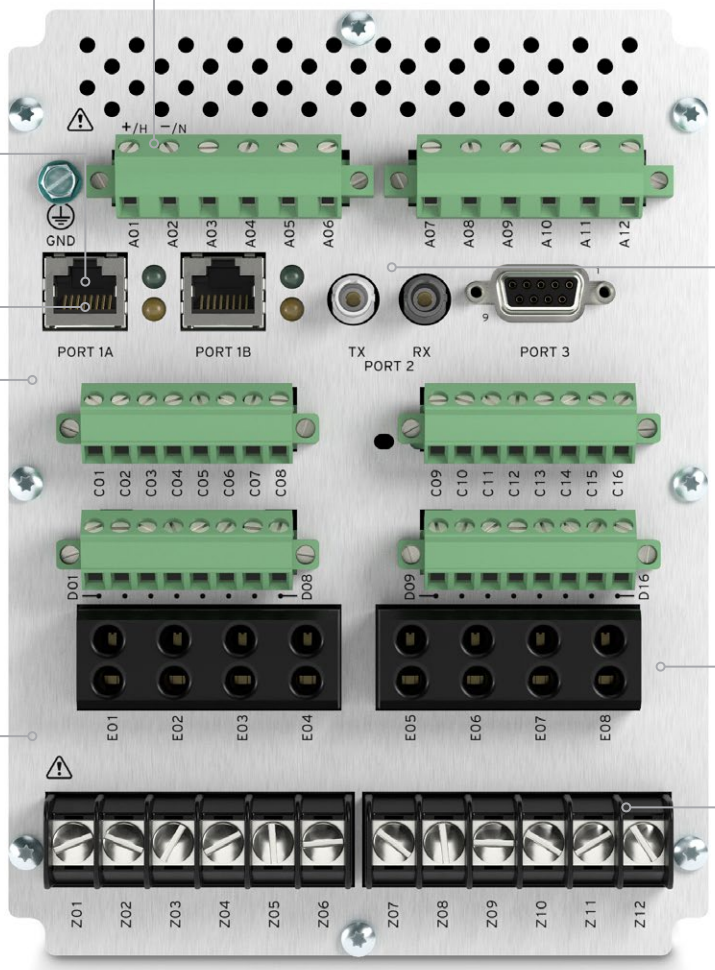
Integrated web server enables direct relay access for metering and monitoring data.

Fiber-optic serial port provides quick and easy engineering access.

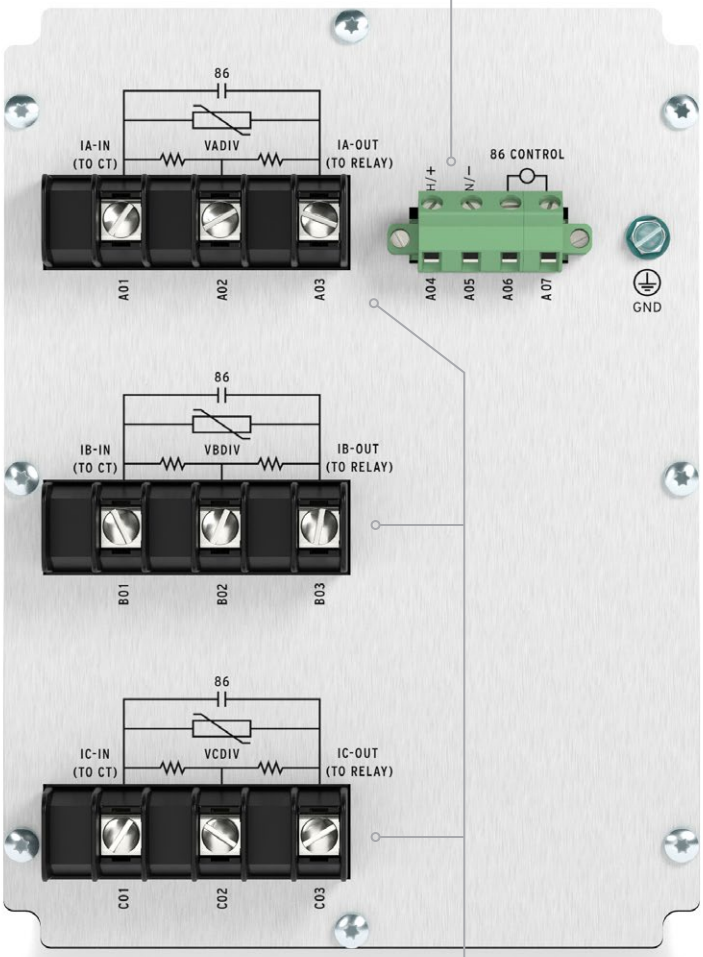
Card slots include positions for optional I/O.

Slot for optional 8 AFD card.

Combined voltage and current I/O card creates more space for additional I/O.



SEL-HZM Overview



Bypass relay power supply and control.

LED indicates bypass relay status.

Three phase-segregated high-impedance inputs.

Applications

Bus Protection

Apply the SEL-787Z for single-zone, high-impedance bus protection on systems with identical CT ratios and saturation characteristics. Three sensitive, independent high-impedance elements in the SEL-787Z provide fast and reliable bus differential protection. Each high-impedance element has two setting levels for added reliability. These elements can quickly detect low ground fault currents and issue a trip signal before remote protection acts at adjacent stations.

Transformer Protection

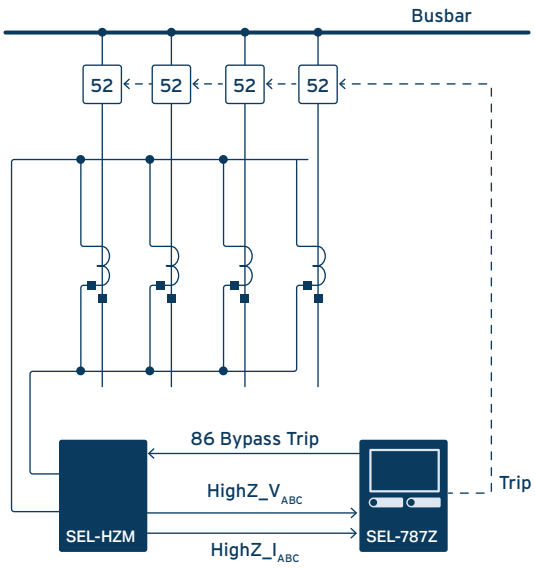
The three sensitive, independent high-impedance elements in the SEL-787Z can be used to provide sensitive REF protection on transformers with grounded-wye connections. Two high-impedance elements can be applied for high-voltage and low-voltage windings that are wye-connected and grounded. Apply with instantaneous and time-overcurrent elements to protect against phase-to-phase faults and external ground-to-bushing faults.

Backup Overcurrent Protection

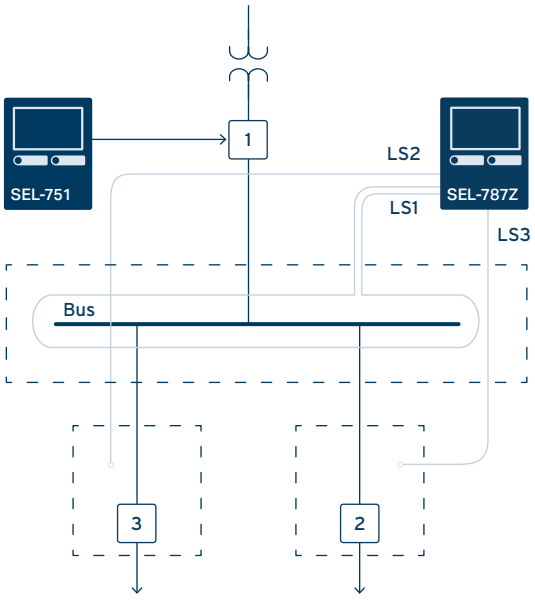
Overcurrent elements in the SEL-787Z provide backup overcurrent protection for transformer protection. Use instantaneous overcurrent elements in the SEL-787Z for phase and ground overcurrent protection for bushing faults. Time-overcurrent elements can be applied to coordinate the phase and ground protection.

Arc-Flash Mitigation

Improve safety and prevent damage to switchgear with arc-flash detection in the SEL-787Z. Use point sensors, window sensors, loop sensors, or a combination to protect a variety of switchgear configurations. The SEL-787Z can be configured with eight arc-flash sensor inputs. High-speed output contacts obtain the fastest response to arcing faults.



SEL-787Z applied for bus protection.



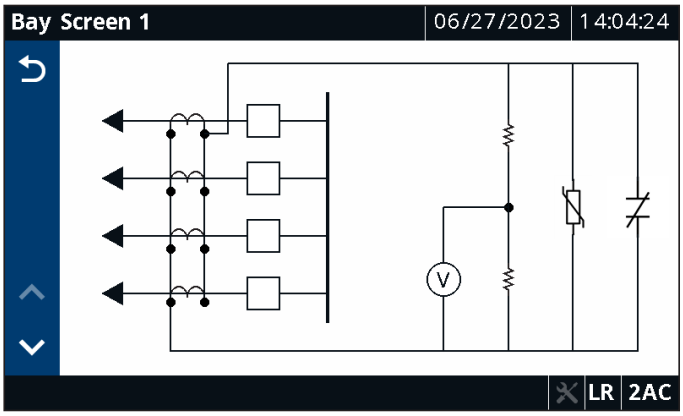
LS1—LS3 are arc-flash detection inputs, point or clear-jacketed fiber sensors.

Touchscreen Display Features and Functions

Use the 5-inch, 800 × 480 color touchscreen display to view metered quantities, phasor diagrams, relay settings, event summaries, target statuses, and Sequential Events Recorder (SER) data.

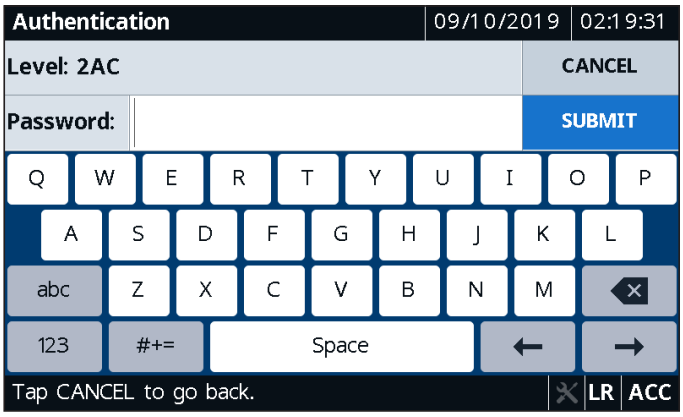
Bay Screens and Bay Control

Select from predefined bay screens, or configure as many as five custom bay screens using the ACSELERATOR® Bay Screen Builder SEL-5036 Software and ACSELERATOR QuickSet® SEL-5030 Software. You can control one breaker, eight two-position disconnects, and two three-position disconnects and can view analog and digital data in a contextual display.



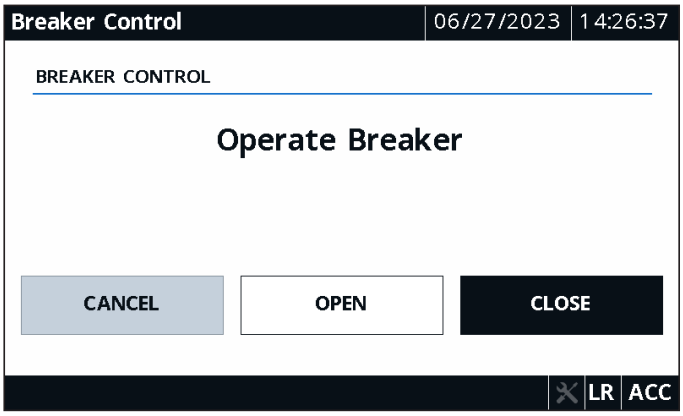
Secure Access Controls

Access device information or adjust settings in the field without a laptop. Multiple authentication levels protect sensitive settings and configuration data while still allowing field technicians to read data from the device. The onscreen keyboard allows you to quickly and easily enter passwords, search for Relay Word bits, and enter settings.



On-Screen Breaker Control

With a Level 2 access password, users may control breakers, issuing Pulse, Trip, or Close commands from the touchscreen. The display clearly identifies the current breaker status and requests confirmation before any control commands are issued.

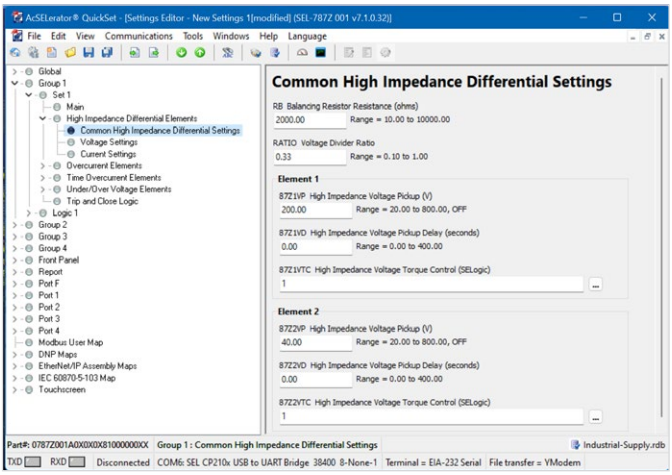


Easy to Set and Use

Use QuickSet Software to Set, Monitor, and Control the SEL-787Z

With QuickSet, you can:

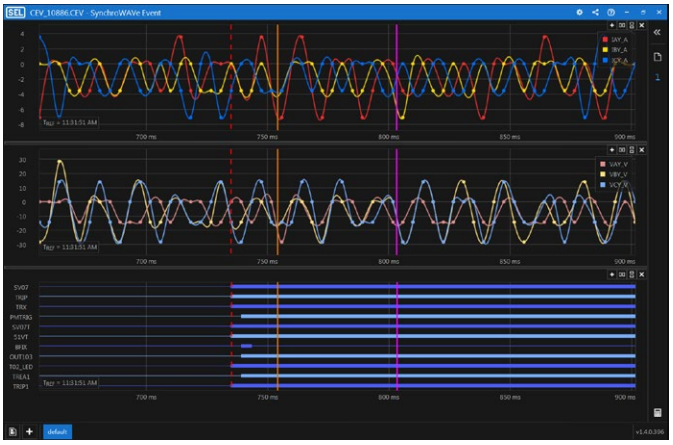
- Save engineering time while keeping flexibility. Communicate with the SEL-787Z through any ASCII terminal, or use the QuickSet graphical user interface.
- Develop settings offline with a menu-driven interface and completely documented help screens. You can speed up installation by copying existing settings files and modifying application-specific items.
- Simplify the setting procedure with the rules-based architecture to automatically check interrelated settings. Out-of-range or conflicting settings are highlighted for correction.



Use SEL-5601-2 SYNCHROWAVE® Event Software to Retrieve and Display Event Reports Recorded by the SEL-787Z

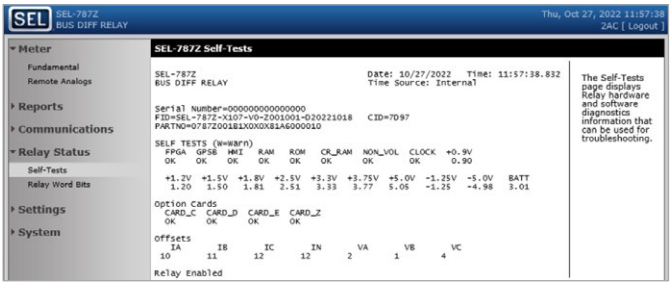
With SYNCHROWAVE software, you can:

- Display event report oscillograms. You can view each report as a plot of magnitude versus time and select analog and digital points to build a custom display. You can analyze arc-flash events using light intensity and current waveforms recorded during the arc fault.
- Retrieve event reports using serial or Ethernet communications links.



Get Information Easily With the Integrated Web Server

Access basic SEL-787Z information on a standard Ethernet network with the built-in web server. You can view the relay status, SER data, metering information, and settings with easy access within a local network. For increased security, web server access requires a relay password and the information is limited to a read-only view. You can also upgrade relay firmware through the web server.



SEL-787Z Options

Expansion Cards
4 Digital Inputs (DI), 4 Digital Outputs (DO)
4 DI, 4 DO With High-Speed, High-Current DO
4 DI, 3 DO (2 Form C, 1 Form B)
3 DI, 4 DO, 1 Analog Output (AO)
4 Analog Inputs (AI), 4 AO
8 AI
8 DI
14 DI
8 DO
8 AFD Inputs

Other Options
Conformal Coating
Configurable Labels
SEL-4520 Arc-Flash Test Module
SEL-C804/SEL-C814 Fiber-Optic AFD Sensors and Accessories

Order expansion cards for field upgrades.

Retrofit Replacement Kits

Mount the SEL-787Z into multiple locations using our complete line of mounting and enclosure options. You can choose from panel-mount, rack-mount, wall-mount, indoor, or outdoor configurations.

No cutting or drilling is required when you use the optional mounting kits. Replacing existing protection is quick and easy!

Visit **selinc.com/applications/mountingselector** to see the complete selection of mounting and enclosure kits.

SEL-787Z Specifications

SEL-787Z High-Impedance Differential Relay	
Displays	2 × 16-character LCD 5-inch color touchscreen display, 800 × 480 pixels
AC Current Inputs	5 A or 1 A phase and 5 A, 1 A, or 200 mA neutral
AC Voltage Inputs	300 Vac continuous, 600 Vac for 10 seconds
Output Contacts	The relay supports Form A, B, and C outputs.
Optoisolated Control Inputs	DC/AC control signals: 250, 220, 125, 110, 48, or 24 V As many as 26 inputs are allowed in ambient temperatures of 85°C (185°F) or less. As many as 34 inputs are allowed in ambient temperatures of 75°C (167°F) or less. As many as 44 inputs are allowed in ambient temperatures of 65°C (149°F) or less.
Sampling Rate	60 Hz: 40 samples per cycle (unfiltered) 50 Hz: 48 samples per cycle (unfiltered)
Frequency	System frequency: 50, 60 Hz
Arc-Flash Time-Overlight® Elements (TOL1—TOL8)	Pickup time: 2—5 ms Dropout time: 1 cycle
Communications Protocols	SEL (Fast Meter, Fast Operate, and Fast SER), Modbus TCP/IP, Modbus RTU, DNP3, FTP, IRIG-B, Telnet, SNTP, EtherNet/IP, firmware-based IEEE 1588 PTP, IEC 61850 Edition 2, IEC 60870-5-103, the Parallel Redundancy Protocol (PRP), RSTP, and MIRRORED BITS communications.
Language Support	English and Spanish
Power Supply	110—250 Vdc or 110—240 Vac Input voltage range: 85—300 Vdc or 85—264 Vac 24—48 Vdc Input voltage range: 19.2—60.0 Vdc
Operating Temperature	−40° to +85°C (−40° to +185°F) Note: LCD contrast is impaired for temperatures below −20°C (−4°F) and above +70°C (+158°F).
Certifications	To view certifications for the SEL-787Z, please visit **selinc.com/company/certifications**.

SEL-HZM High-Impedance Module	
Burden	500 Ω, 1,000 Ω, or 2,000 Ω stablizing resistors
MOV Clamping Voltage	7,800 J maximum transient energy rating 850 V maximum continuous ac voltage rating

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