SEL-487E

TRANSFORMER PROTECTION RELAY

BUDGETARY RETAIL
Quantity 1: $6,750

FEATURED APPLICATIONS

Multiwinding Protection—Configure the SEL-487E Transformer Protection Relay for transformer differential protection in transformer applications using up to five restraint currents. This includes single transformers with tertiary windings. Use three independent restricted earth fault (REF) elements for protection of grounded-wye windings.

Sensitive Turn-to-Turn Fault Detection—Avoid catastrophic transformer failure. Detect turn-to-turn faults involving as little as two percent of the total winding with the patented negative-sequence differential element.

High-Speed, Adaptive Differential Protection—Implement a two-stage slope that automatically adapts to internal or external fault conditions, even with CT saturation and heavily distorted waveforms, for fast, sensitive, dependable, and secure differential protection. The adaptive differential element responds to internal fault conditions in less than 1.5 cycles.

Diverse Transformer Applications—Protect large transformers with breaker-and-a-half high- and low-side connections. Also, configure for a typical two-winding transformer application, and use the remaining three-phase current inputs for feeder backup protection.

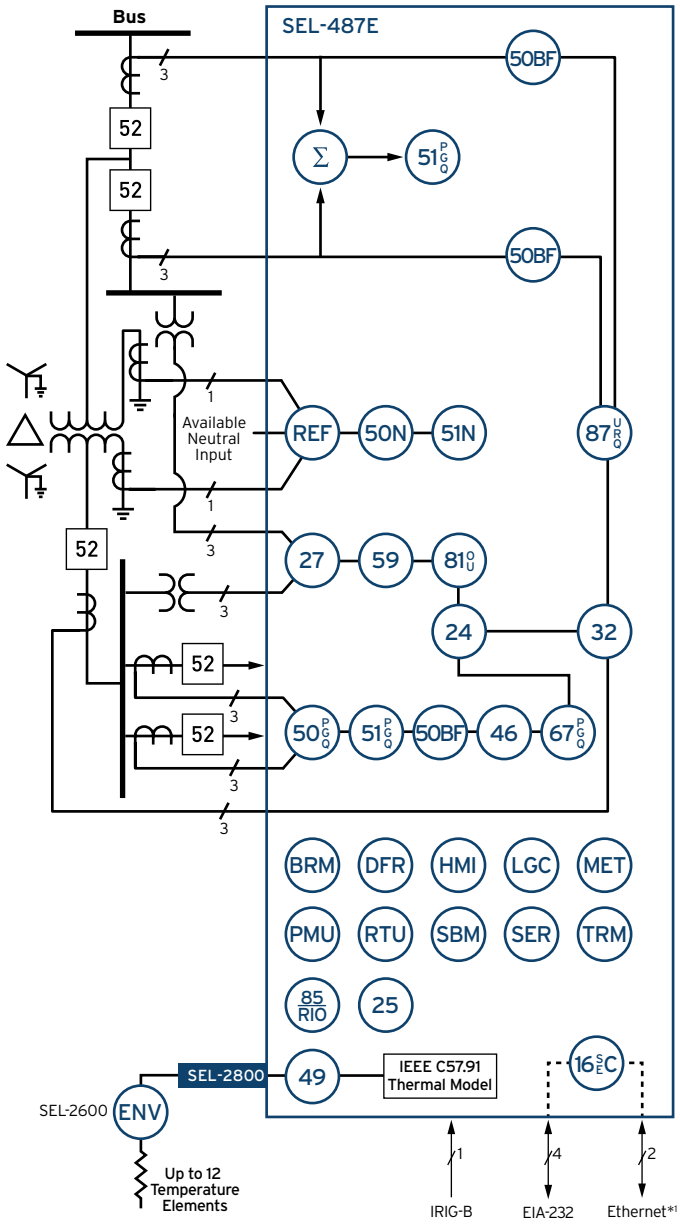
Generator Step-Up Protection—Protect generator step-up (GSU) transformers, and apply the built-in thermal elements (requires the SEL-2600 RTD Module) for monitoring generator and transformer winding temperatures simultaneously.

Advanced Asset Monitoring—Track transformer wear with through-fault and thermal monitoring. Reduce inefficient and costly breaker maintenance with advanced breaker monitoring. Monitor substation dc power systems for out-of-tolerance voltage levels or excessive voltage ripple.

Station Phasor Measurement Unit (PMU)—Improve power system quality with SEL synchrophasors (IEEE C37.118) from all 24 analog channels (6 voltage and 18 current sources) in your relay. Use synchrophasors over serial or Ethernet communications to easily detect reactive loop flows, turn state estimation into state measurement, and provide early warning of potential system instability. Implement real-time control by receiving synchrophasor messages from two PMUs, and take action based on local and remote messages.

Dependable Backup Protection—Provide backup protection with five phase, negative-sequence, and zero-sequence overcurrent elements and ten configurable time-overcurrent elements. Quickly identify the faulted phase with faulted-phase indications for each overcurrent element. Set up breaker failure protection with subsidence detection to rapidly detect breaker failure and minimize system coordination times.

FOR COMPLETE INFORMATION, VISIT SELINC.COM/SEL-487E



ANSI NUMBERS/ACRONYMS AND FUNCTIONS	
16 SEC	Access Security (Serial, Ethernet)
24	Volts/Hertz
25	Synchronism Check
27	Undervoltage
32	Directional Power
46	Current Unbalance
49	Thermal
50BF	Breaker Failure Overcurrent
50N	Neutral Overcurrent
50 (P,G,Q)	Overcurrent (Phase, Ground, Neg. Seq.)
51N	Neutral Time-Overcurrent
51 (P,G,Q)	Time-Overcurrent (Phase, Ground, Neg. Seq.)
59	Overvoltage
67 (P,G,Q)	Directional Overcurrent (Phase, Ground, Neg. Seq.)
81 (O,U)	Over-/Underfrequency
85 RIO	SEL Mirrored Bits® Communications
87 (U,R,Q)	Transformer Differential (Unrestrained, Restrained, Neg. Seq.)
DFR	Event Reports
ENV	SEL-2600
HMI	Operator Interface
LGC	Expanded SELogic® Control Equations
MET	High-Accuracy Metering
PMU	Synchrophasors
REF	Restricted Earth Fault
RTU	Remote Terminal Unit
SER	Sequential Events Recorder

ADDITIONAL FUNCTIONS	
BRM	Breaker Wear Monitor
LDP	Load Data Profiling
SBM	Station Battery Monitor
TRM	Transformer Monitor

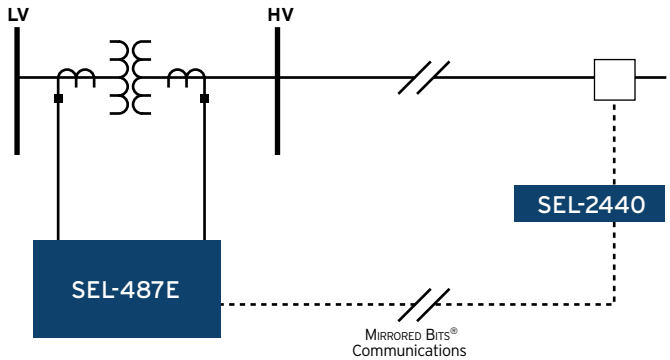
[1]Copper or Fiber-Optic
*Optional Feature

FLEXIBLE COMMUNICATIONS

An Ethernet card option provides two copper or fiber ports for failover redundancy.

Available Ethernet communications protocols include FTP, Telnet, Simple Network Time Protocol (SNTP), DNP3 LAN/WAN, IEC 61850, IEEE C37.118 synchrophasors, and Parallel Redundancy Protocol (PRP).

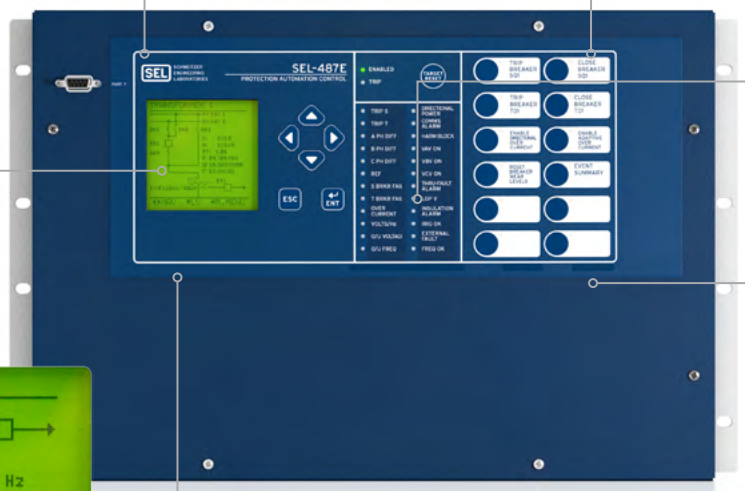
All four independent EIA-232 serial ports support SEL Fast Messages, SEL ASCII, Compressed ASCII, SEL Fast Operate, SEL Fast Meter, SEL Fast SER, enhanced SEL Mirrored Bits communications, DNP3 Level 2 Outstation plus dial-out, Virtual Terminal, and communications with the SEL-2600 RTD Module (SEL-2800 serial-to-fiber converter required).



SEL-487E FRONT- AND REAR-PANEL OVERVIEW

Chassis is available in a vertical (5U only) or horizontal, panel-mount or rack-mount hardware package. Size options of 5U, 6U, or 7U allow ordering of up to two I/O boards* (shown as 7U horizontal rack mount with two I/O boards).

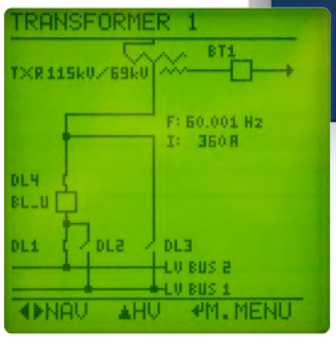
SEL provides a worldwide, ten-year product warranty and –40° to +85°C operating temperature range. (Note: LCD contrast is impaired for temperatures below –20°C and above +70°C.)



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

Include programmable analog quantities for readouts.

Use default pushbuttons, or program your own pushbutton actions with user-configurable labels.



*Optional Feature

Select your own system bay configuration, and control as many as 5 circuit breakers and 20 disconnect switches using the built-in mimic diagrams.

Demodulated IRIG-B precise-time input.

Three rear-panel and one front-panel EIA-232 serial ports.

Optional dual copper, fiber-optic, or mixed Ethernet ports. Communications protocols include FTP, Telnet, synchrophasors, DNP3 LAN/WAN, SNTP, PRP, and IEC 61850.*

There are a total of 18 current channels (5 three-phase restraint and 3 REF current inputs, 5 A/1 A CT input options) and 6 voltage channels (2 three-phase voltage inputs). Voltage channels can also be ordered as low-energy analog (LEA) inputs to be compatible with IEEE C37.92 compliant sensors. Order in standard terminal blocks (shown) or in a Connectorized® hardware configuration.

NOMINAL CURRENT TRANSFORMER (CT) INPUTS

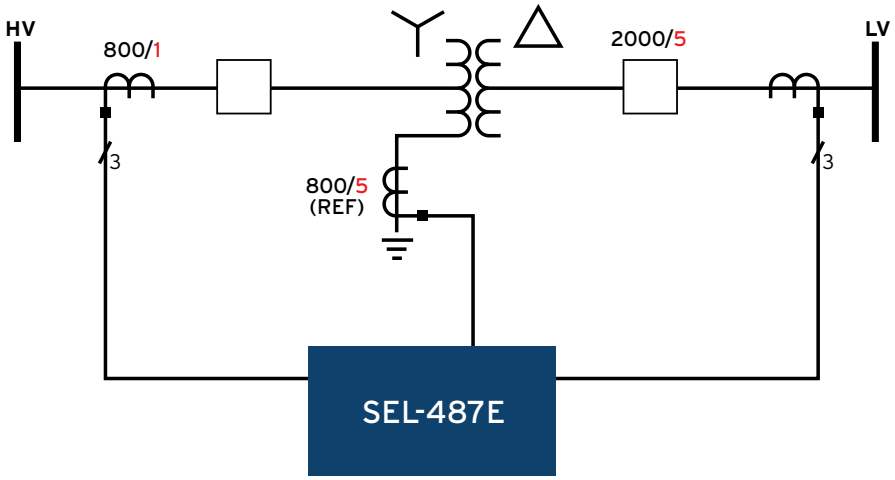
Select Your Ideal 5 A/1 A Nominal CT Combination

The SEL-487E allows you to order any combination of nominal CT inputs at 5 A and 1 A for each transformer winding, including the following examples:

- 1 A high-voltage, 5 A low-voltage CTs
- 1 A high-voltage, 5 A low-voltage, 1 A tertiary CTs

Support up to 35:1 CT ratio mismatch without loss of performance. Possible applications include:

- Breaker-and-a-half installation
- Busbar protection for up to five terminals with mismatched CT ratios



HARMONIC BLOCKING AND RESTRAINT

Combine Harmonic Blocking, Harmonic Restraint, and Waveform Detection for Protection Reliability

Secure the differential element against inrush by using harmonic blocking, harmonic restraint, and waveform detection; select the best combination for your application. Combine harmonic blocking and restraint elements to provide optimum operating speed and security for transformers with higher harmonic content. Waveform detection is designed to prevent undesired operations during inrush conditions for transformers with low second-harmonic content.

A bidirectional differential overcurrent algorithm supervises the waveform detection to identify an internal fault during transformer energization. Fast subcycle external fault detection adds security during external faults with CT saturation. The harmonic blocking element includes common or independent second- and fourth-harmonic blocking and independent fifth-harmonic blocking.