



Two-Winding Current Differential Protection



The SEL-387A Relay provides a competitive edge through lowered costs and enhanced features for two-winding transformer protection, monitoring, and control.

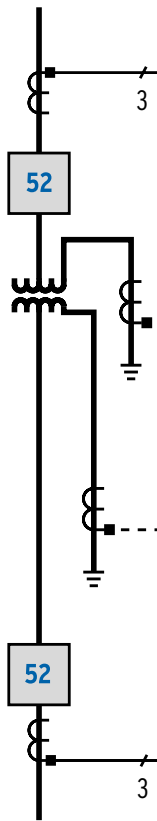
Major Features and Benefits

- **Protection**
Protect important two-winding power transformers using a combination of single- or dual-slope percentage differential characteristic, overcurrent protection, and optional two-element Restricted Earth Fault (REF) protection.
- **Monitoring**
Simplify fault and system disturbance analysis with event reports and the Sequential Events Recorder (SER). Use breaker contact wear and substation battery voltage monitors to efficiently dispatch maintenance resources. Monitor critical operating temperatures using the SEL-2600 RTD Module.
- **Control**
Locally control relay operation and initiate or block automation sequences from remote sites or control systems.
- **Integration and Automation**
Reduce total project costs through remote communications capabilities and elimination of external control switches and indicating lamps. Use remote communications capabilities for control, monitoring, and alarm purposes.

Making Electric Power Safer, More Reliable, and More Economical

SEL-387A Relay

Functional Overview



SEL-387A Relay

50^{P G Q}

Overcurrent
• Phase
• Ground
• Neg. Seq.

51^{P G Q}

Time-Overcurrent
• Phase
• Ground
• Neg. Seq.

50G

Overcurrent
• Ground

51G

Time-Overcurrent
• Ground

67G

Restricted Earth Fault (REF)*

50G

Overcurrent
• Ground

51G

Time-Overcurrent
• Ground

67G

Restricted Earth Fault (REF)*

50^{P G Q}

Overcurrent
• Phase
• Ground
• Neg. Seq.

51^{P G Q}

Time-Overcurrent
• Phase
• Ground
• Neg. Seq.

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Three-Phase Current Differential

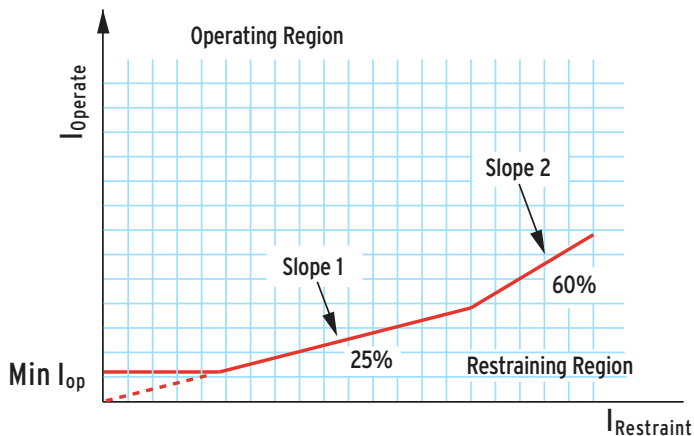
- SELogic® Control Equations
- Event Reports
- Sequential Events Recorder
- Breaker Wear Monitor
- Station Battery Monitor
- ASCII, Binary, and Distributed Port Switch Communication
- Remote and Local Control Switches
- Phase, Ground, Neg. Seq., Differential, and Harmonic Metering
- Restrained and Unrestrained Differential Elements
- Second- and Fourth-Harmonic Blocking or Restraint
- Fifth-Harmonic and DC Blocking
- CT and Transformer Connection Compensation
- Temperature Metering
- Two Restricted Earth Fault Elements*
- Additional I/O*
- DNP 3.00 Level 2 Slave Protocol*

*Optional Functions

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Differential Protection

The SEL-387A Relay has three differential elements. These elements use operate and restraint quantities calculated from the two winding input currents. Set the differential elements with either a single- or dual-slope percentage differential characteristic, as shown below.



The SEL-387A Relay provides security against conditions resulting from both system and transformer events that can cause relay misoperation. Use the fifth-harmonic element to prevent relay misoperation during allowable overexcitation conditions. Even harmonic elements (the second and fourth harmonics) provide security against inrush currents during transformer energization, complemented by the dc element, which measures the dc offset. The even harmonic elements offer the choice between harmonic blocking and harmonic restraint. In the blocking mode, select either blocking on an independent phase basis or on a common basis, as per application and philosophy. The second-, fourth-, and fifth-harmonic thresholds are set independently, and the dc blocking and harmonic restraint features are independently enabled.

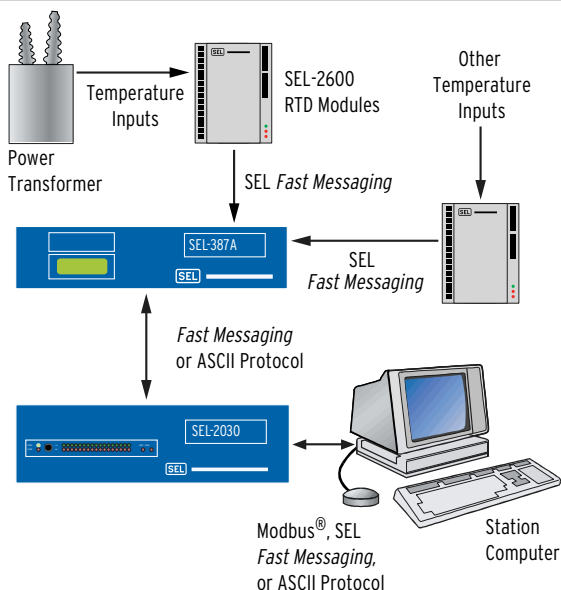
Overcurrent Protection

Each set of three-phase current input terminals has phase, negative-sequence, and residual overcurrent elements. Each set includes definite-time, instantaneous, and inverse-time overcurrent elements as standard. Neutral inputs are optional. All definite-time and inverse-time elements are torque-controlled.

Restricted Earth Fault Protection

The Restricted Earth Fault (REF) function compares the directions of neutral current and winding residual current for sensitive ground fault detection in grounded-wye or autotransformer-connected windings. The SEL-387A Relay has two optional REF elements.

Transformer Temperature Metering



Typical Functional Diagram for Collecting Temperature Data

Specify the SEL-387A Relay to provide temperature metering of a single three-phase transformer or three independent single-phase transformers using one or two SEL-2600 RTD Modules.

Metering and Alarm Functions

Primary Current: IA, IB, IC, IR, 3I2

- Instantaneous
- Demand
- Peak Demand
- Harmonic Spectrum (fundamental to fifteenth harmonic)

Secondary Current: IA, IB, IC, IR, 3I1, 3I2

- Instantaneous, with magnitude and angle

Differential Quantities: IOP, IRT, IF2, IF5

- Operate
- Restraint
- Second and fifth harmonics
- Time-delayed alarm threshold for fifth harmonic

Sequential Events Recorder (SER)

Use time-tagged sequential event messages recorded by the SEL-387A Relay to analyze the time relationships between assertion and deassertion of logical elements within the relay. Apply the relay with an SEL-2030 Communications Processor to quickly and automatically receive SER messages from the relay in an efficient binary format.

Enhanced Automation Elements

A convenient set of automation features reduces the need for external metering and control devices. Automation elements include 16 each of the following: local control switches, remote control switches, latch control switches, and local display points.



Local control switch elements provide the functionality of separately mounted switches without the cost burden of installing and documenting physical devices. You can use each of the 16 switches for a variety of purposes including inputs to internal relay logic and for operator-entered switch values to other devices or systems.

Remote control switch elements are set, cleared, and/or pulsed via serial port commands from remote systems or human-machine interfaces. Typical applications include control switches for SCADA operations such as trip, close, and settings group selection.

Use latch control switches to retain the status of logical element conditions, such as supervisory on/off selector switch positions, through a loss of dc power to the relay.

Display points provide 16 programmable messages for the front-panel liquid crystal display (LCD). Use SELogic® control equations to drive the LCD with any logical point in the relay.

Advanced SELogic Control Equations

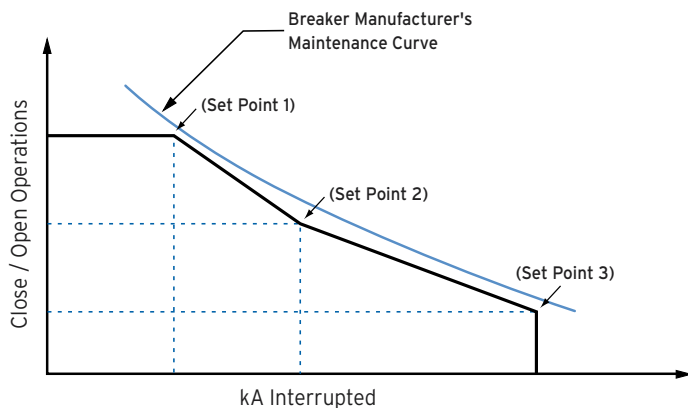
Advanced SELogic control equations put relay logic in the hands of the protection engineer. Assign relay inputs to suit the application. Logically combine selected relay elements for various control functions, and assign outputs to logic functions. In addition to Boolean-type logic, 16 general-purpose SELogic control equation timers eliminate external timers for custom protection or control schemes. Each timer has independent time-delay pickup and dropout settings.

SEL-387A

Current Differential and Overcurrent Relay

Intelligent Breaker Monitor

For each terminal, the SEL-387A Relay keeps track of the number of breaker operations, total interrupted current by pole, and contact wear by pole. Schedule timely breaker maintenance based on actual breaker wear that is related to the breaker manufacturer's maintenance curves.



General Specifications

■ AC Current Inputs (six total, standard model)

1 A or 5 A I_{nom} (specify on order); 3 x I_{nom} continuous; 100 x I_{nom} one-second thermal rating; linear to 20 x I_{nom} symmetrical.

■ Burden

0.27 VA @ I_{nom} for $I_{nom} = 5$ A; 0.13 VA @ I_{nom} for $I_{nom} = 1$ A

■ Frequency and Phase Rotation

60/50 Hz system frequency and ABC/ACB phase rotation are user-settable.

■ Output Contact Ratings (eight total, standard model)

30 A make per IEEE C37.90-1989 paragraph 6.7.2; 6 A continuous carry; MOV protected.

■ Optoisolated Input Ratings (six total, standard model)

24, 48, 110, 125, 220, or 250 Vdc, level-sensitive (specify voltage when ordering).

■ Serial Communication

Two rear-panel and one front-panel EIA-232 serial ports.
One rear-panel EIA-485 serial port with 2.1 kVdc isolation.
Baud selection 300, 1200, 2400, 4800, 9600, 19200 (per port).

■ Time-Code Input

Demodulated IRIG-B accepted at EIA-232 Port 2 and the EIA-485 port.

■ Power Supply Ratings

24/48 V: 18-60 Vdc; <25 W

48/125 V: 38-200 Vdc or 85-140 Vac; <25 W

125/250 V: 85-350 Vdc or 85-264 Vac; <25 W

■ Operating Temperature

-40° to +85°C (-40° to +185°F)

■ Mounting Options

Horizontal rack-mount, horizontal panel-mount, and horizontal projection panel-mount versions available.

■ Production Dielectric Strength Tests

V, I Inputs, Optoisolated Inputs, and Output Contacts: 2500 Vac for 10 seconds.

Power supply: 3100 Vdc for 10 seconds.

Commitment to Quality

Schweitzer Engineering Laboratories, Inc. is committed to quality. Our certification to the ISO 9001 quality standard and our ten-year product warranty are examples of this commitment. We encourage and appreciate your feedback, and we will use this information to continually improve our products and services.



Contact Us

SEL sales representatives are prepared to assist you. Contact your nearest sales representative, application engineer, or customer service representative at (509) 332-1890. Visit our web site at www.selinc.com for more information.

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