

Current Differential and Overcurrent Relay

Two-Winding Current Differential Protection



Versatile features and low cost make the SEL-387A Relay the best choice for two-winding transformer protection, monitoring, and control.

Features and Benefits

Protection

Protect important two-winding power transformers using a combination of single- or dual-slope percentage differential characteristic, overcurrent protection, harmonic blocking, phase angle compensation, and optional two-element restricted earth fault (REF) protection.

Monitoring

Simplify fault and system disturbance analysis with oscillographic event reports and the Sequential Events Recorder (SER). Use breaker contact wear, substation battery voltage monitor, and through-fault monitor to efficiently dispatch maintenance resources. Monitor critical operating temperatures using the SEL-2600 RTD Module.

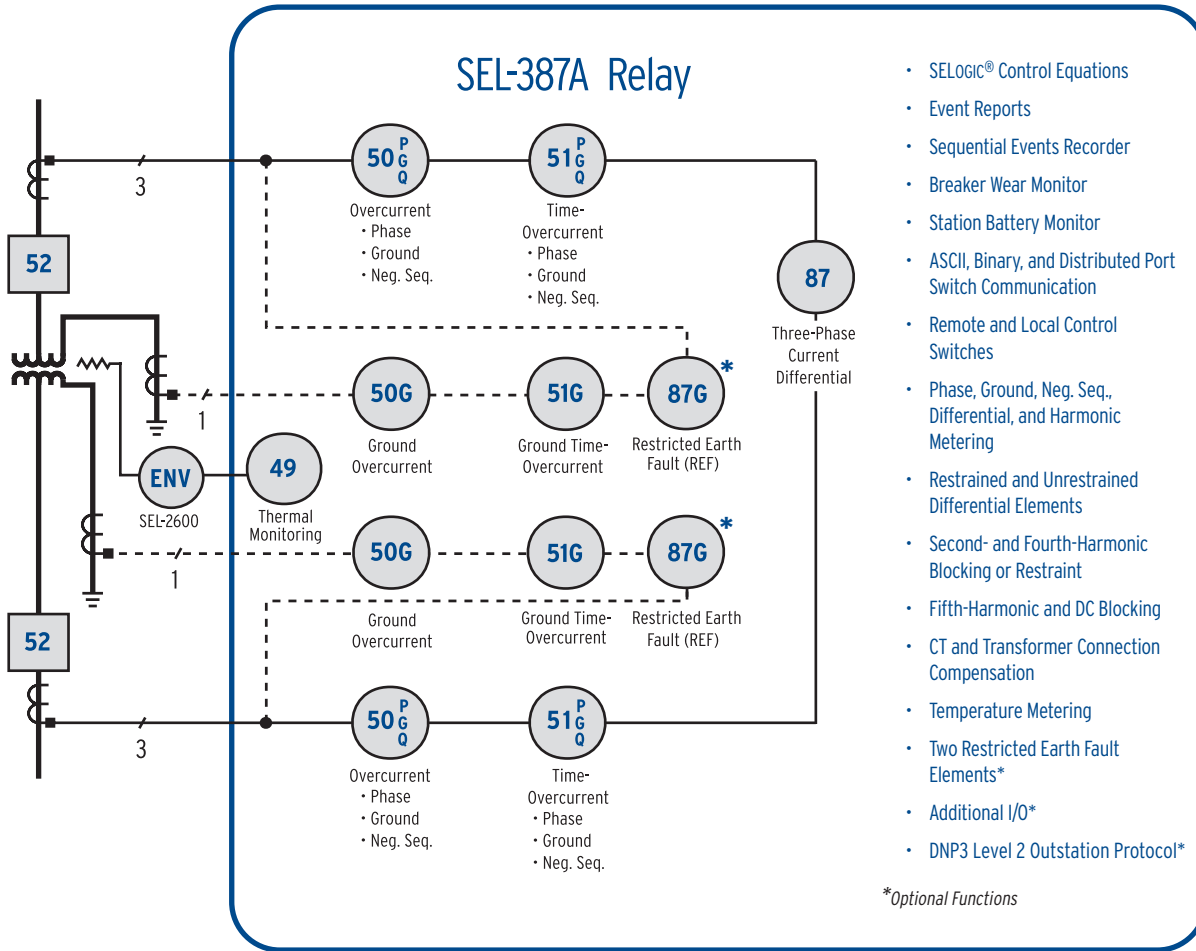
Control

Locally control relay operation and initiate or block automation sequences from remote sites or control systems. Use SELogic® control equations with SELogic variables, timers, latch bits, and remote control elements to customize advanced protection and control schemes. Local programmable control elements and programmable text display points allow for an advanced local operator interface.

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.

Functional Overview

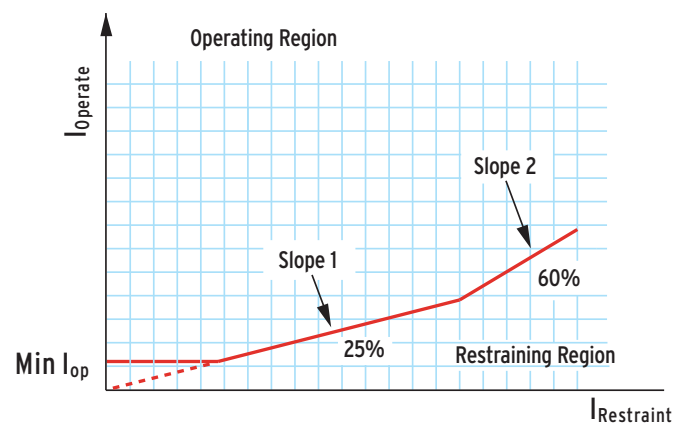


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Differential Protection

The SEL-387A Current Differential and Overcurrent Relay has three differential elements that 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.

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.



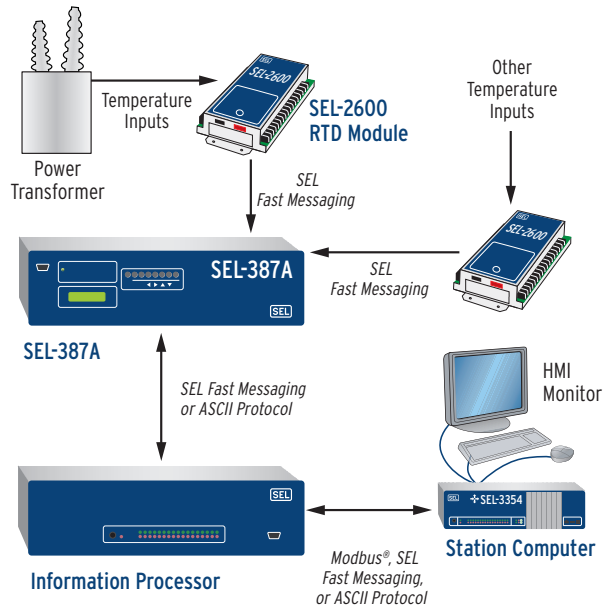
Overcurrent Protection

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 15th harmonic)

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

- Instantaneous, with magnitude and angle

Differential Quantities: IOP, IRT, IF2, IF5

- Operate
- Restraint
- 2nd and 5th harmonics
- Time-delayed alarm threshold for 5th 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-2032 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.

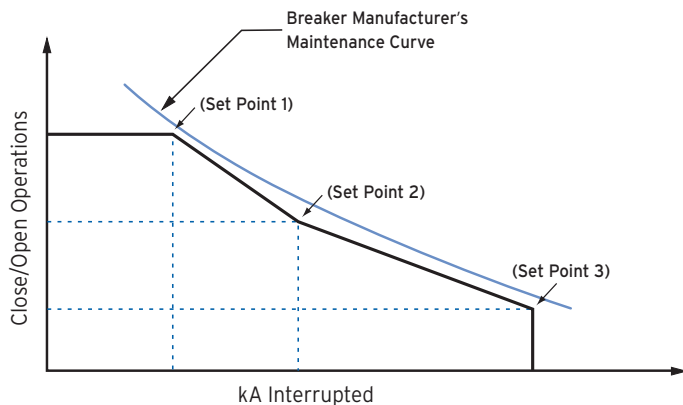
Advanced SELoGic Control Equations

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.

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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 (6 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

Standard Control Input and Output Ranges

24, 48, 110, 125, or 250 Vdc

Standard configuration provides 6 inputs and 8 outputs, <5 ms pickup/dropout times with 30 A make, 6 A continuous duty. Additional I/O boards may be selected with standard inputs and outputs, a combination of standard inputs and high-current interrupting outputs, or a combination of standard inputs and high-speed, high-current interrupting outputs.

Serial Communication

2 rear-panel and 1 front-panel EIA-232 serial ports
1 rear-panel EIA-485 serial port with 2.1 kVdc isolation
Data speed: 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



Pullman, Washington USA
Tel: +1.509.332.1890 • Fax: +1.509.332.7990 • www.selinc.com • info@selinc.com

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