



## SEL-387 Current Differential and Overcurrent Relay

# Multi-Winding Current Differential Protection



*Apply the SEL-387 Relay for protection of two-, three-, or four-winding power transformers. Use overcurrent elements from combined CT inputs for backup protection.*

### Features and Benefits

#### ■ Protection

Protect power transformers with as many as four windings using a combination of single- or dual-slope percentage differential characteristics, overcurrent protection, and restricted earth fault protection.

#### ■ Control

Locally control relay operation, and initiate or block automation sequences from remote sites or control systems.

#### ■ Monitoring

Simplify fault and system disturbance analysis with event reports and sequential events recorder. Use breaker contact wear and substation battery voltage monitors to efficiently dispatch maintenance resources.

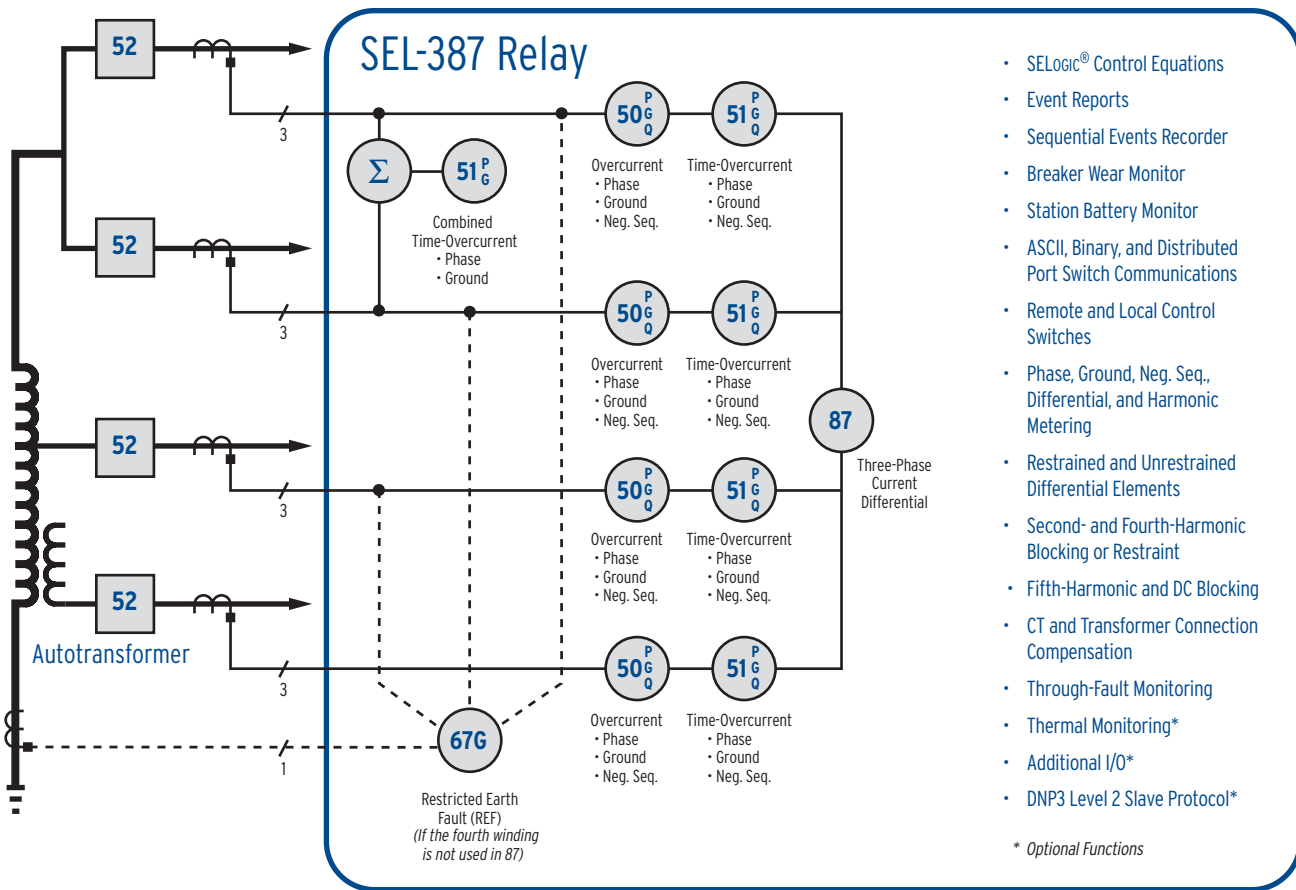
Specify optional thermal modeling per IEEE C57.91:1995 for mineral-oil immersed transformers. Use the thermal element to activate a control action, or issue an alarm when your transformer is in danger of excessive insulation aging or loss of life.

#### ■ 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.

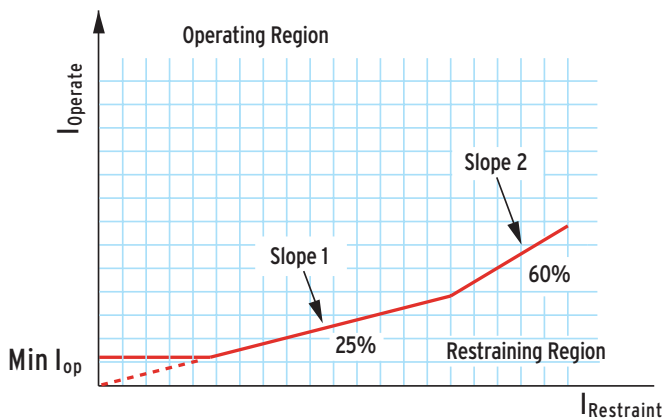
***Making Electric Power Safer, More Reliable, and More Economical®***

## Functional Overview



## Differential Protection

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



The SEL-387-5 and SEL-387-6 provide 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 of the four, three-phase current input terminals has a total of eleven overcurrent elements, nine of which are torque controlled. For backup overcurrent protection in ring-bus or breaker-and-a-half configurations, two combined overcurrent elements operate on the sum of the currents from Windings 1 and 2 and/or Windings 3 and 4. The combined currents from two separate breaker CTs emulate the current as if from a single bushing CT applied on the power transformer.

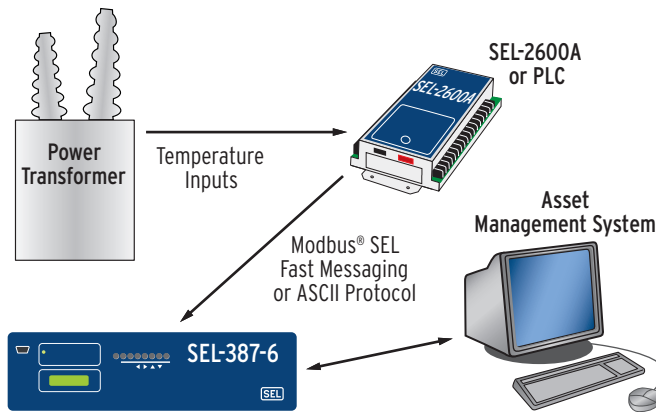
## Restricted Earth Fault Protection

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.

## Through-Fault Monitoring

Through-fault currents can cause transformer winding displacement leading to mechanical damage and increased transformer thermal wear. SEL-387-5 and SEL-387-6 through-fault event monitors gather current level, duration, and date/time for each through fault.

## Transformer Thermal Monitoring

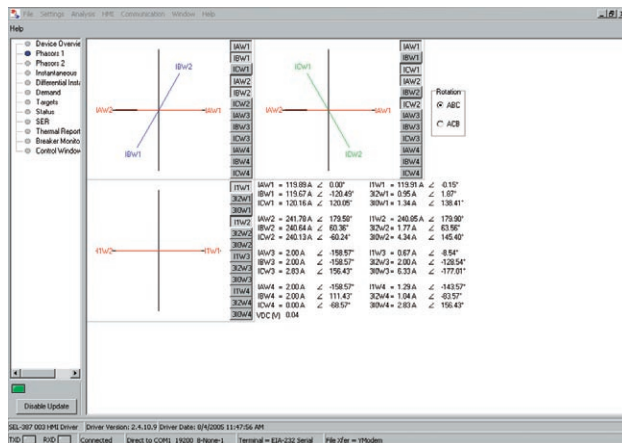


Typical functional diagram for collection of temperature data.

Specify the SEL-387-6 Relay to provide thermal modeling for monitoring and protection of a single three-phase transformer or three independent single-phase transformers.

## Simplified Setup and Troubleshooting

- Use ACSELERATOR QuickSet SEL-5030 Software in the SEL-387-5 and SEL-387-6 to customize your protection. Set and edit relay configuration, settings, and logic.
- View the HMI screens in ACSELERATOR QuickSet to check wiring polarity and connections.



ACSELERATOR QuickSet HMI simplifies configuration and troubleshooting.

## Metering 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

## Enhanced Automation Elements

A convenient set of automation features reduces the need for external metering and control devices. Automation components include 16 each of the following:

- **Local control switch elements** provide the functionality of separately mounted switches without the cost burden of installing and documenting physical devices.
- **Remote control switch elements** are set, cleared, and/or pulsed via serial port commands from remote systems or human-machine interfaces.
- **Latch control switch elements** retain the status of logical element conditions, such as supervisory on/off selector switch positions.
- **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.



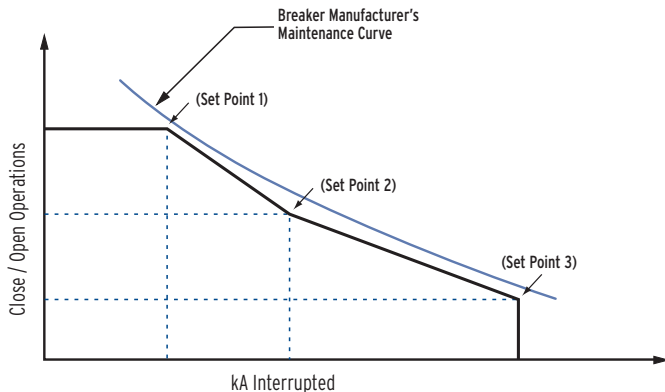
## Advanced SELoGic Control Equations

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-387 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 (twelve total)

#### 5 A nominal

15 A continuous, 500 A for 1 second, linear to 100 A symmetrical

Burden 0.27 VA @ 5 A

#### 1 A nominal

3 A continuous, 100 A for 1 second, linear to 20 A symmetrical

Burden 0.13 VA @ 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 worldwide, ten-year product warranty are examples of this commitment. We encourage and appreciate your feedback about the use of SEL equipment, and we will use this information to continually improve our products and services.



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