SEL-352

Breaker Failure and Monitoring Relay

Complete Breaker Protection, Monitoring, and Control

Apply the SEL-352 Relay to ring-bus, breaker-and-a-half, or multiple-bus configurations.

Features and Benefits

Protection
Select one of five preconfigured breaker failure schemes for ring-bus, breaker-and-a-half, or double-bus applications. Or, build your own for custom applications.

Control
Configure timers, programmable latches, and variables in a wide range of control applications. Use the synchronism check element to build a reclose function and the point-on-wave closing to reduce charging currents when switching in capacitor banks.

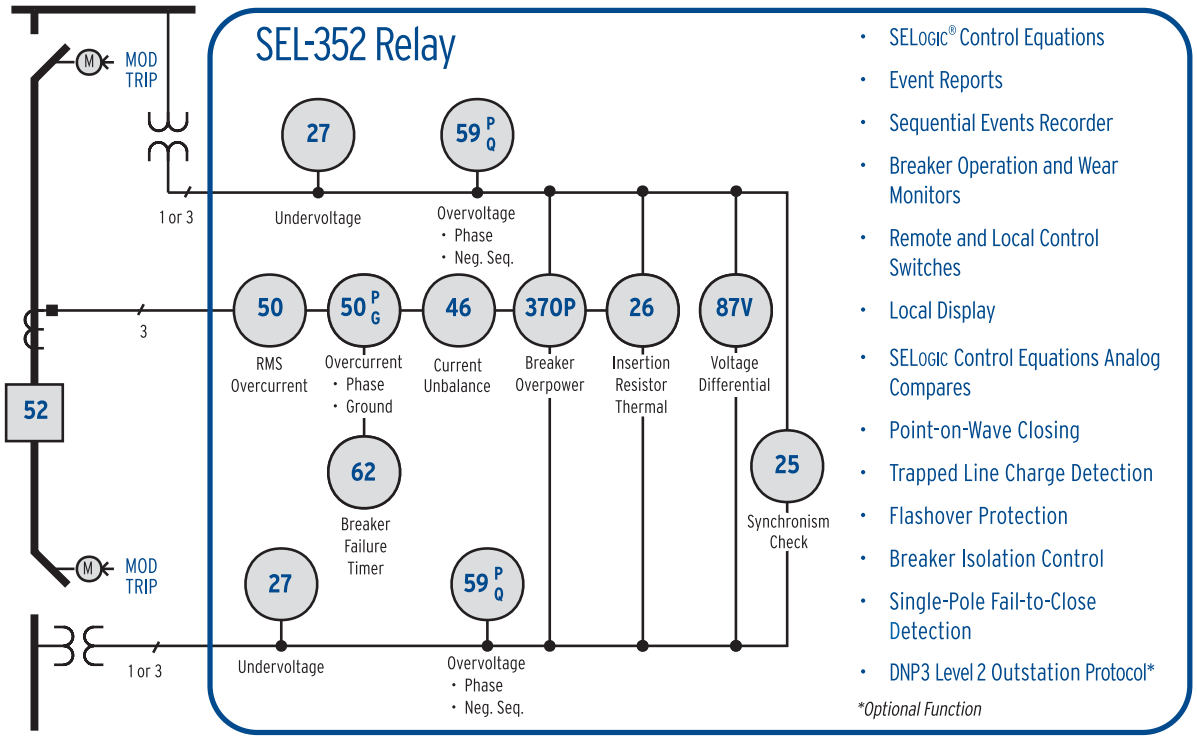
Monitoring
Apply breaker monitor information such as breaker pole flashover, loss-of-dielectric pressure, and breaker resistor status to your reliability-centered maintenance (RCM) program.

Reporting
Analyze Sequential Events Recorder (SER) and oscillographic event reports for rapid commissioning, testing, and post-fault diagnostics.

Communications
DNP3 Level 2 Outstation, ASCII, and binary protocols are available for communications with SCADA, local HMI, or modems.

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

Functional Overview



- SELOGIC® Control Equations
- Event Reports
- Sequential Events Recorder
- Breaker Operation and Wear Monitors
- Remote and Local Control Switches
- Local Display
- SELOGIC Control Equations Analog Compares
- Point-on-Wave Closing
- Trapped Line Charge Detection
- Flashover Protection
- Breaker Isolation Control
- Single-Pole Fail-to-Close Detection
- DNP3 Level 2 Outstation Protocol*

**Optional Function*

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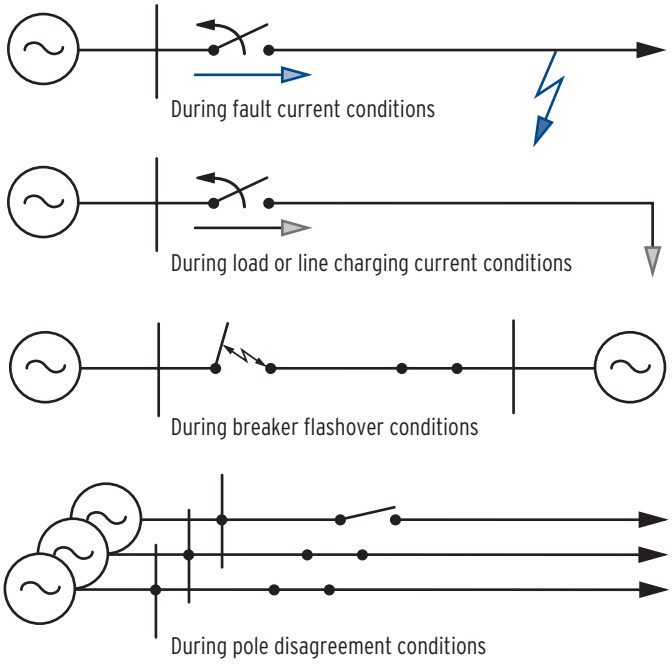
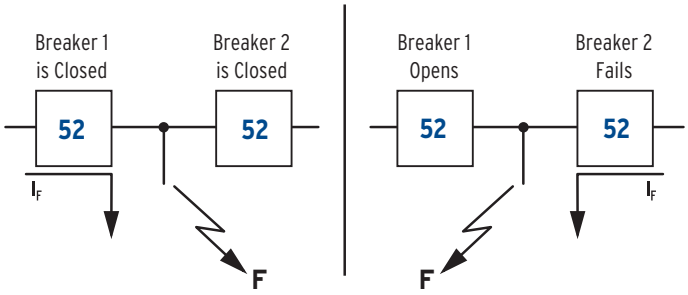
Breaker Failure Use Protection

The breaker failure function protects against the following conditions:

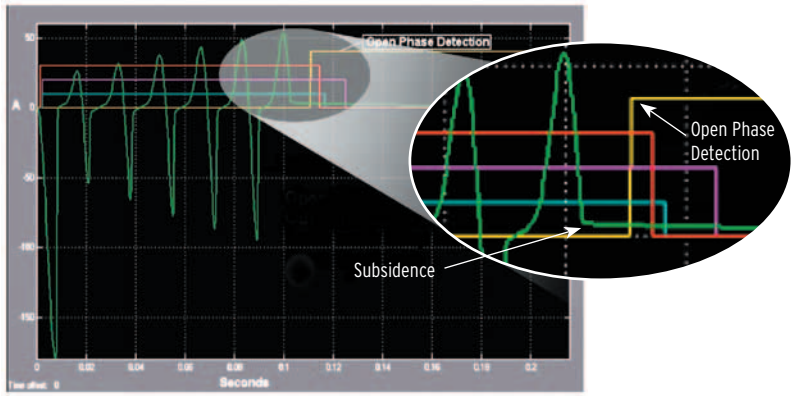


Apply any one of five preconfigured schemes, or modify them to suit your application. Schemes available include those that prevent misoperation or sequential timing during unfavorable current distribution in breaker-and-a-half or ring-bus systems.



For Fault F, Breaker 2 doesn't depend on Breaker 1 opening to initiate breaker failure (no fault current through Breaker 2 when Breaker 1 is closed). Instead, Breaker 2 initiates breaker failure on receipt of the trip pulse.

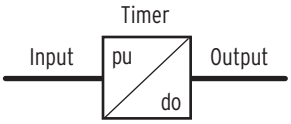
Innovative subsidence logic recognizes a "breaker open" condition by inspection of the ac current waveform. This logic produces the fast dropout of overcurrent detection elements required for secure breaker failure protection.



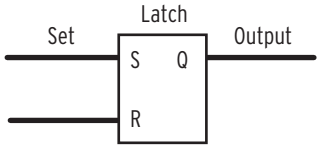
Control

The SEL-352 Relay provides you with the tools and permits you the flexibility to create control schemes as diverse and varied as there are applications. Tools include 29 settable timers, 44 latches, 22 comparators, 16 local bits, 16 remote bits, and numerous elements.

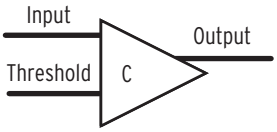
29 Settable Timers



44 Programmable Latches



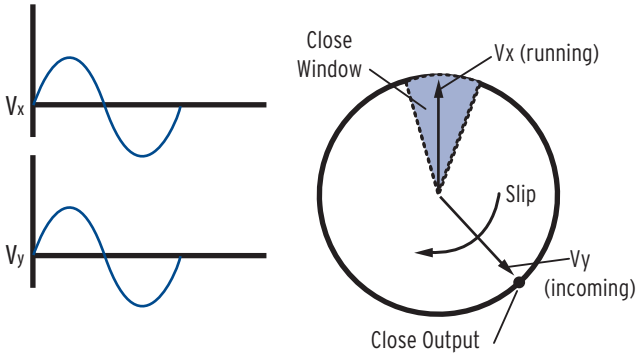
22 Programmable Comparators



SELOGIC® control equations provide the flexibility to configure the tools using AND, OR, NOT, parenthesis, and analog compare operators.

For example, use the synchronous condition element as a basis to create a complete single- or three-pole reclosing scheme.

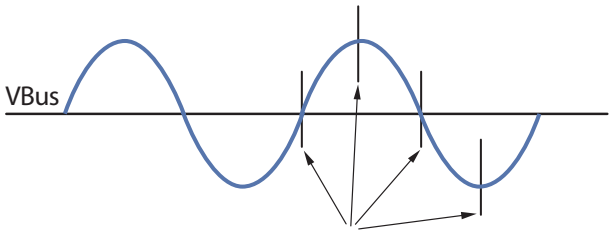
Synchronous Control



When synchronizing two systems, the relay first calculates the frequency difference (slip frequency) between the two systems. Next, including the mechanical closing time of the breaker, the relay calculates the optimum instance to issue the close command.

Point-On-Wave Closing

Reduce the inrush current when energizing your capacitor bank by using the point-on-wave element.



Close at zero crossings, peaks, or anywhere in between with better than 200 microsecond accuracy.

Breaker Monitoring

Extensive breaker monitoring provides valuable information to assess the breaker condition. Use this information to schedule reliability-centered maintenance when required, instead of time-based maintenance.

Example Breaker Operations and Alarms

BREAKER OPERATIONS

#	DATE	TIME	OPERATION	OP. TIME (ms) ELECT.	OP. TIME (ms) MECH.	ENERGY (MJ)	CURRENT (A)
1	09/26/09	16:24:37.401	TRIPA	29	16	0.03	5472
2	09/26/09	16:24:37.401	TRIPB	29	16	0.01	5454
3	09/26/09	16:24:37.401	TRIPC	29	16	0.01	5457
4	09/26/09	16:22:03.651	CCA	8	12	0.02	1248
5	09/26/09	16:22:03.651	CCB	8	12	0.01	1239
6	09/26/09	16:22:03.651	CCC	10	12	0.00	1236

OPERATION SUMMARY

FROM 09/26/09

	TRIPA	TRIPB	TRIPC	CLOSEA	CLOSEB	CLOSEC
Number of Operations	1	1	1	1	1	1
Ave. Elect. Time (ms)	29.0	29.0	29.0	8.0	8.0	10.0
Ave. Mech. Time (ms)	16.0	16.0	16.0	12.0	12.0	12.0
Last Elect. Time (ms)	29	29	29	8	8	10.0
Last Mech. Time (ms)	16	16	16	12	12	12
Total Energy (MJ)	0.03	0.01	0.01	0.02	0.01	0.00
Total Current (A)	5472	5454	5457	1248	1249	1236
Percent Wear (%)	100	100	100			

BREAKER ALARMS

	ALARM	TOTAL COUNT
Failed CB trip resistors put in service	FTRS	0
Failed CB close resistors put in service	FCRS	0
52A contradicts voltage	52ACV	1
Current while open	CWO	0
Trip while open	TWO	1
CB did not close	BDNC	0
Current after MOD trip	CAMT	0
MOD contradicts current	MCC	0
Slow trip	ST	0
Slow close	SC	0
Potential transformers disagree	PTD	2

Reporting

SER With Programmable Element Names

The programmable Sequential Events Recorder (SER) records the latest 512 events, which helps you diagnose breaker or system problems. Settable element names make the SER user-friendly.

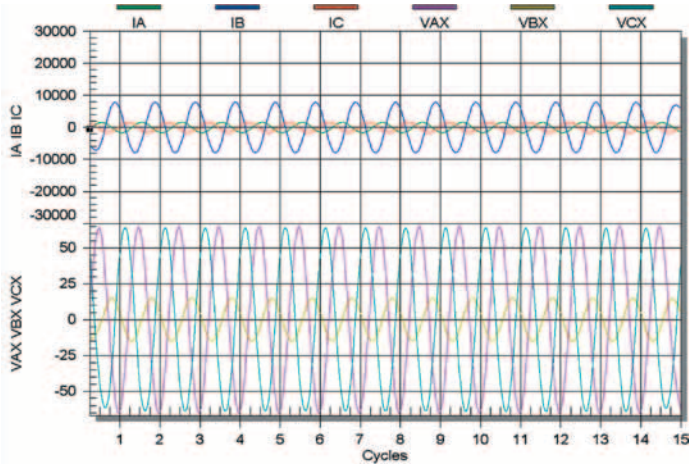
Example SER Event Reports

```
=>SER<ENTER>
Example Circuit Breaker Date: 09/26/09 Time: 13:22:35.297

FID=SEL-352-R100-D090926

Example Report Label

#    Date        Time           Element    State

1    09/26/09    13:22:04.004   50FAULT    Asserted
2    09/26/09    13:22:04.033   TRIP       Asserted
3    09/26/09    13:22:04.050   RETRIP     Asserted
4    09/26/09    13:22:04.100   BFR_TRIP   Asserted
5    09/26/09    13:22:04.116   TRIP       Deasserted
6    09/26/09    13:22:04.125   50FAULT    Deasserted
=>
```

SEL-352 Breaker Failure and Monitoring Relay

Digital Fault Recorder

- Event report length of 15, 30, or 60 cycles
- Ten seconds of nonvolatile event storage
- Data reported at 4, 8, 16, or 64 samples per cycle
- Programmable prefault time
- SEL-5601 compatible



Capture system current and voltages during fault conditions.

General Specifications

AC Voltage Inputs

120 V_{L-N}, three-phase, four-wire connection

150 V_{L-N}, continuous (connect any voltage up to 150 Vac)

365 Vac for 10 seconds

Burden: 0.13 VA @ 67 V; 0.45 VA @ 120 V

AC Current Inputs

5 A nominal: 15 A continuous, 500 A for 1 second, linear to 100 A symmetrical, 1250 A for 1 cycle

Burden: 0.27 VA @ 5 A; 2.51 VA @ 15 A

1 A nominal: 3 A continuous, 100 A for 1 second, linear to 20 A symmetrical, 250 A for 1 cycle

Burden: 0.13 VA @ 1 A; 1.31 VA @ 3 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 Communications

Two rear-panel and one front-panel EIA-232 serial ports
One 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: 20–60 Vdc; <15 W

125/250 V: 85–350 Vdc or 85–264 Vac; <15 W

12 W maximum for all supplies

Operating Temperature

-40° to +85°C (-40° to +185°F)

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