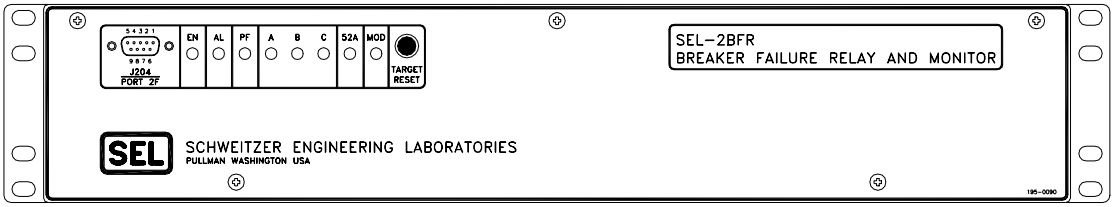
SEL-2BFR Breaker Failure Relay and Monitor



Data Sheet

- Detects failure to interrupt fault, load, or line-charging currents
- Apply to single-breaker, ring-bus, and breaker-and-a-half installations
- Operates in single- or three-pole trip schemes
- Thermal models protect trip and close resistors
- Detects current unbalance when one or two poles fail to close
- Detects current through an open breaker (flashover)
- Provides detailed breaker operation data with 15-cycle event reports
- Stores 100 breaker operation summaries
- Programmable mask logic for flexible application and testing
- Serial communication ports allow local or remote interaction with the relay

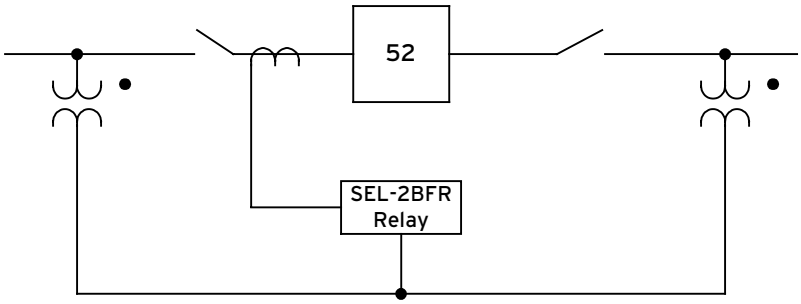


Figure 1: Basic AC Connections of the SEL-2BFR Relay

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GENERAL DESCRIPTION

The SEL-2BFR Relay is a single- or three-pole breaker failure protection and monitoring package. The relay provides classical overcurrent-based breaker failure protection for a wide variety of breaker arrangements. Additional features include metering, breaker operating time monitors, energy interruption monitors, flashover protection, phase-discordance protection, and breaker resistor thermal protection. These features combine with event reporting and remote setting capabilities to make the SEL-2BFR Relay an excellent choice for circuit breaker protection.

Figure 1 shows a one-line diagram of the ac connections. Only three connections are required for most relay functions.

CIRCUIT BREAKER PROTECTION LOGIC

The SEL-2BFR Relay has six current-driven breaker protection schemes, including one specially designed for ring-bus or breaker-and-a-half applications. Tailor the relay to your circuit breaker protection requirements by selecting the most appropriate scheme.

The relay detects failures to interrupt fault, load, or line-charging current. It also detects failures of breaker poles to complete a close sequence. When potential transformers are used, the relay can detect open breaker pole flashover failures.

Independent phase current detectors, protection logic, and timers make the relay easy to apply on both simple systems and more complicated breaker arrangements such as single-pole trip installations.

When you use a motor-operated disconnect switch (MOD) with the protected breaker, the SEL-2BFR Relay can trip the MOD to isolate the failed breaker when phase current drops below a settable value. This logic replaces an overstress scheme on the MOD. When an MOD is not installed, the MOD logic may be used to indicate a “Safe to Disconnect” condition to personnel.

THERMAL MODELS

A breaker can occasionally operate incompletely, leaving trip or close resistors in service. The energy dissipated in a breaker resistor due to current flow can exceed the resistor thermal rating within seconds, resulting in dangerous and expensive resistor failure.

When potential transformer inputs are used, the SEL-2BFR Relay monitors energy dissipated in breaker trip and close resistors using six thermal models. When a resistor temperature estimate reaches preset limits, the SEL-2BFR Relay can alarm, generate an event report, or trip the lockout relay. Resistor thermal models have pending failure and failure temperature levels.

The thermal protection function does not require an initiating input; it monitors the breaker continuously. Thermal protection can be disabled when trip and close resistors are not used.

Event Reporting and Breaker Monitoring

The SEL-2BFR Relay stores the nine latest event reports. These 15-cycle reports contain current, voltage, input, output, and relay element data presented on a quarter-cycle basis.

This information simplifies event analysis and improves understanding of the protective scheme operation. An operator can retrieve the event reports locally or remotely to determine the causes of relay and breaker operations.

The SEL-2BFR Relay stores summaries of the 100 latest events in nonvolatile memory. Event type, mechanical and electrical operating times, and breaker energy are stored along with the date and time of operation. Using this breaker history, operators can monitor breaker wear and effectively schedule routine breaker maintenance.

Programmable Mask Logic

Programmable mask logic is another feature included in the SEL-2BFR Relay. Programmable mask logic allows you to configure the 86BF TRIP and 5 auxiliary outputs to operate when any of 40 protective elements or logic outputs pick up. You can implement complete application-specific protective schemes with a minimum of wiring and panel space. Programmable mask logic also simplifies relay testing.

Serial Communication Ports

The relay has two serial communication ports that provide local or remote access to setting, metering, and event reporting capabilities.

A two-level password security scheme prevents unauthorized access to the relay. The user examines settings and data in the first level. Setting and logic changes can be made from the second level only.

The relay requires no special communication software. Access the relay with a dumb terminal, printing terminal, or computer with serial port and terminal emulation software.

CIRCUIT BREAKER PROTECTION LOGIC

PROTECTION OVERVIEW

The SEL-2BFR Relay performs many circuit breaker protective relaying, diagnostic, and data recording functions. The relay detects the following circuit breaker failure modes:

- Failure to clear a fault (six available schemes)
- Failure to trip under load
- Failure of the breaker auxiliary contact to indicate that the breaker tripped
- Failure to complete trip sequence due to trip resistor(s) remaining inserted
- Failure to complete close sequence due to close resistor(s) remaining inserted
- Failure to close
- Failure while open: breaker pole flashover detected

The SEL-2BFR Relay provides reset logic for applications with and without motor-operated disconnects. The relay also provides instantaneous or time-delayed retripping. The following sections describe the logic for each of these protection schemes.

PROTECTION WHILE TRIPPING FAULT CURRENT

The SEL-2BFR Relay provides six different protection schemes to safeguard the circuit breaker under fault current conditions. While the schemes share elements and timers, each is independent. You may enable only one protection scheme at a time. The SEL-2BFR Relay applies the single chosen scheme to all three breaker poles.

In ring-bus and breaker-and-a-half installations, two circuit breakers must operate to interrupt line current. Current distribution between the two breakers is unknown until the first breaker opens. This causes an uncertainty with respect to the timing of 50FT overcurrent element assertion. This uncertainty is not present in a single breaker arrangement.

Timing uncertainty is accounted for in the SEL-2BFR Relay breaker protection schemes intended for these complex bus/breaker arrangements. The SEL-2BFR Relay is intended to protect a single breaker, regardless of the bus/breaker arrangement. In breaker-and-a-half and ring-bus arrangements, you must use an independent breaker failure relay for each breaker.

PROTECTION WHILE TRIPPING LOAD OR LINE-CHARGING CURRENT

The 50LD overcurrent element is used in the failure to trip load current breaker protection scheme. The 50LD element should pick up when the protected breaker is closed. This scheme detects failures of the breaker to open when breaker current is lower than the 50FT setting, such as end-of-section faults and load breaking operations.

When the protected breaker is part of a ring-bus or breaker-and-a-half installation, load current may be very low due to unequal current distribution between the two breakers. Failure to trip load current logic may still be used to protect the breaker.

Thermal Protection of Close and Trip Resistors

If the protected breaker is equipped with trip and close resistors and three-phase potentials are available on both sides of the breaker, you can use the SEL-2BFR Relay thermal protective elements to protect breaker resistors. Occasionally, a trip or close resistor can be left in service following a breaker operation. The SEL-2BFR Relay can detect that condition, model the energy accumulated in the resistor, and trip the protected breaker or 86 lockout relay when resistor energy reaches a preset level.

The Relay Word bits CTF (Close resistor Thermal Failure) and TTF (Trip resistor Thermal Failure) assert when any Close or Trip resistor thermal model has reached the failure energy level and current is flowing in the hot resistor phase. If you set the CTF and TTF bits in the M86T logic mask, the relay asserts the 86BF TRIP outputs when a resistor thermal failure occurs.

The relay models cooling of the breaker resistors using settable time constants. The thermal elements do not drop out until the resistor thermal models have cooled below the element thresholds. This function helps prevent hot resistors from being returned to service.

Protection for Current Through an Open Breaker (Flashover)

The relay contains logic to detect breaker pole flashover failure. If a flashover is detected and continues until the 62FP and 62FF timers expire, the FOPF (Flashover Pending Failure) bit then the FOBF (Flashover Breaker Failure) bit assert in the Relay Word.

Protection for Failure to Close

The SEL-2BFR Relay includes logic that detects a failure of one or two breaker poles to close. Because the logic operates based on current flowing in the breaker poles, protection is not dependent upon the operation of auxiliary contacts. Thus, this logic is not subject to misoperation due to mechanical failures in the breaker or contacts.

MOD Trip Logic

You can set the SEL-2BFR Relay to operate a motor-operated disconnect switch following a breaker failure. The protection scheme must meet two requirements:

- The relay must be able to measure all current flowing in the MOD.
- The MOD must have an "a" configuration auxiliary contact to indicate status.

If you do not use an MOD on the protected breaker, consider using this logic to indicate a "Safe to Disconnect" condition for station personnel.

52BV Logic

The 52BV Relay Word bit asserts if the 52A input is deasserted while no phase current is above the 50LD setting. The 52BV bit deasserts when the 52A input asserts or when any phase current exceeds the 50LD setting.

ALARM LOGIC

In addition to the relay ALARM output, the ALRM bit is available in the Relay Word. The ALRM bit indicates dangerous or abnormal conditions related to operation of the protected circuit breaker.

The relay sets the ALRM bit for one second and stores a message in the alarm message buffer when any of the following conditions are detected:

Failed CB trip resistors put in service	Failed CB close resistors put in service
52A contradicts voltage	Current while open
Trip while open	CB did not close
Blown pot fuse	Current after MOD Trip
MOD contradicts current	Volts across closed CB
Slow trip	Slow close

LOGIC

OPTOISOLATED INPUTS

Six optoisolated input circuits are provided: TRIP A, TRIP B, TRIP C, 52A STATUS, MOD STATUS, CLOSE. Assert an input by applying nominal control voltage to the appropriate terminal pair. These inputs are included in the Relay Word as bits in Row 7. Table 1 provides an overview and Table 2 provides a description of the Relay Word bits.

RELAY WORD

The Relay Word consists of seven eight-bit rows containing relay elements, timer outputs, and logic outputs. Each bit in the Relay Word is either a logical 1 or logical 0:

- 1 indicates that the element is picked up or logic condition is true
- 0 indicates that the element is dropped out or logic condition is false

The logic description defines the logic conditions in the Relay Word. The relay updates the Relay Word each quarter cycle.

Table 1: SEL-2BFR Relay Word

Row	Relay Word Bits							
0	EN	AL	PF	A	B	C	52A	MOD
1	FBF	LBF	LPF	50FT	50LD	50MD	52BV	TTF
2	FOBF	FOPF	59FO	59H	ALRM	TC	TB	TA
3	PDBF	PDPF	87UA	87UB	87UC	86RS	MDT	CTF
4	CRFA	CRPA	TRFA	TRPA	CRFB	CRPB	TRFB	TRPB
5	CRFC	CRPC	TRFC	TRPC	DOPA	DOPB	DOPC	47Q
6	*	86BF	A1	A2	A3	A4	A5	ALARM
7	*	*	CLOS	MOD	52A	TPC	TPB	TPA

PROGRAMMABLE OUTPUT LOGIC

The relay uses programmable logic masks to control the 86BF TRIP and programmable output relays. Logic masks are saved in nonvolatile memory with the other settings. They are set with the LOGIC command and retained through losses of control power.

Select Relay Word elements to program each logic mask. If any Relay Word element selected in a logic mask asserts, the output contact associated with the logic mask operates.

Table 2: Relay Word Bit Summary Table

Row	Bit	Description
0	EN	Normal Operation
	AL	ALARM Condition
	PF	Pending Failure Condition
	A	Phase A Breaker Failure
	B	Phase B Breaker Failure
	C	Phase C Breaker Failure
	52A	52A STATUS Input Assertion
	MOD	MOD STATUS Input Assertion
1	FBF	Fault Current Breaker Failure
	LBF	Load Current Breaker Failure
	LPF	Load Current Pending Failure
	50FT	Fault Current Overcurrent Element
	50LD	Load Current Overcurrent Element
	50MD	MOD Overcurrent Element
	52BV	Current-Verified 52B
	TTF	Trip Resistor Thermal Failure
2	FOBF	Flashover Breaker Failure
	FOPF	Flashover Pending Failure
	59FO	Overvoltage Element
	59H	Flashover Overvoltage Element
	ALRM	Breaker Operation Alarms
	TC	C-Phase Retrip Output
	TB	B-Phase Retrip Output
	TA	A-Phase Retrip Output
3	PDBF	Phase Discordance Breaker Failure
	PDPF	Phase Discordance Pending Failure
	87UA	A-Phase Discordance
	87UB	B-Phase Discordance
	87UC	C-Phase Discordance
	86RS	86BF Reset
	MDT	MOD Trip
	CTF	Close Resistor Thermal Failure

Row	Bit	Description
4	CRFA	A-Phase Close Resistor Failure
	CRPA	A-Phase Close Resistor Pending Failure
	TRFA	A-Phase Trip Resistor Failure
	TRPA	A-Phase Trip Resistor Pending Failure
	CRFB	B-Phase Close Resistor Failure
	CRPB	B-Phase Close Resistor Pending Failure
	TRFB	B-Phase Trip Resistor Failure
	TRPB	B-Phase Trip Resistor Pending Failure
5	CRFC	C-Phase Close Resistor Failure
	CRPC	C-Phase Close Resistor Pending Failure
	TRFC	C-Phase Trip Resistor Failure
	TRPC	C-Phase Trip Resistor Pending Failure
	DOPA	A-Phase Delayed Overpower
	DOPB	B-Phase Delayed Overpower
	DOPC	C-Phase Delayed Overpower
	47Q	Negative-Sequence Overvoltage Element
6	*	Reserved for Future Use
	86BF	86BF Trip Contact Output
	A1	A1 Trip
	A2	A2 Trip
	A3	A3 Trip
	A4	A4 Trip
	A5	A5 Trip
	ALARM	ALARM Trip
7	*	Reserved for Future Use
	*	Reserved for Future Use
	CLOS	CLOSE Optoisolated Input
	MOD	MOD STATUS Optoisolated Input
	52A	52A STATUS Optoisolated Input
	TPC	TRIP C Optoisolated Input
	TPB	TRIP B Optoisolated Input
	TPA	TRIP A Optoisolated Input

CONTACT OUTPUTS

The SEL-2BFR Relay has seven contact outputs. All output contacts are rated for circuit breaker tripping duty. These outputs are included in the Relay Word as Row 6. Table 2 lists these Relay Word bits and their descriptions.

PROGRAMMABLE OUTPUT APPLICATIONS

The versatility of programmable output contacts allows you to perform many tasks. The following examples describe programmable output contact applications using the SEL-2BFR Relay.

Breaker Operation Alarm

You can set a programmable output contact to close and indicate when the relay detects a breaker operation alarm condition.

Three-Pole Instantaneous Retrip

You may use an SEL-2BFR Relay programmable output contact to perform instantaneous retrip of the protected circuit breaker. Set a single programmable logic mask with TA, TB, and TC equal to one. Connect the contact in series with a breaker 52A contact and Breaker Trip coil #2. Each time any SEL-2BFR Relay trip input is asserted, the relay asserts the A1 contact, energizing the second breaker trip coil.

Single-Pole Instantaneous Retrip

You may use three programmable output contacts to perform single-pole instantaneous retrip of the protected circuit breaker. In this application, set three individual programmable output contacts to close when a single breaker trip input is asserted. For instance, MA1 could contain the TA bit, MA2 the TB bit, and MA3 the TC bit. Connect each contact in series with the appropriate 52A contact and single-pole trip coil. Each time a single-phase trip input to the SEL-2BFR Relay asserts, the relay asserts the corresponding programmable output contact, energizing the second breaker trip coil and retripping the protected breaker pole.

Loss-of-Potential Indication

In three-pole trip installations, the relay 47Q element asserts to indicate that a potential fuse has blown. Set 47Q in a programmable output contact logic mask and monitor that contact externally using an annunciator, indicator lamp, or sequential events recorder input. When 47Q asserts, the programmable output contact closes, indicating a blown potential fuse.

In single-pole trip installations, you may use the 47Q element in the same manner. However, because the element may assert during single-pole-open intervals, you may want to use a time delayed pickup timer between the relay output contact and the annunciator input or indicator lamp. The time delay should be set longer than the maximum single-pole-open interval. Thus, only permanent output contact closures activate the annunciator.

Hot Resistor Indication

When you use the SEL-2BFR Relay breaker resistor thermal protection elements, you can set a programmable output contact to close, indicating when one or more breaker resistor thermal models contain energy above the pending failure or failure level. You can monitor the contact using an annunciator input, indicator lamp, or sequential events recorder input.

DATA RECORDING

EVENT REPORTING

The relay retains a 15-cycle data record for each of the last 9 events. The record includes input currents and voltages, Relay Word elements, input contacts, and output contacts. The relay saves a report when any of the following occur:

- The relay trips
- User selected Relay Word bits, inputs, or outputs assert
- User executes the TRIGGER command

The relay stores the last nine event reports in a buffer. You can examine any full-length report stored in the relay using the EVENT command. The relay clears the event buffer when relay power is interrupted or when you make a setting or logic change.

The relay stores 100 event summaries in nonvolatile memory. The event summaries are retained through setting changes and losses of control power. Summaries contain breaker operation data such as event type, mechanical and electrical breaker operating times, and the event date and time. You can use this data to monitor breaker wear and more effectively schedule routine breaker maintenance.

METERING

The meter function shows the values of ac current through the breaker, voltage across it, and real and reactive power dissipated in it.

ADDITIONAL FEATURES

SERIAL INTERFACES

The SEL-2BFR Relay is equipped with two serial ports. Generally, one port is used for remote communications via a modem, while the other port is used for local communications.

The baud rate for each port is set by jumpers near the front of the main board. Available baud rates are 300, 600, 1200, 2400, 4800, and 9600. The serial data format is: eight data bits, two stop bits, no parity.

TARGETING

The relay normally displays the targets identified on the front panel. Under normal operating conditions, the Enable (EN) target lamp is lit. The AL, PF, A, B, and C target LEDs latch. These front-panel targets are included in the Relay Word as bits in Row 0. Table 2 lists these Relay Word bits and their descriptions.

The Enable (EN) LED indicates that the relay is energized and operating.

The Alarm (AL) LED asserts for Level 1 access failures, Level 2 access attempts, and self-test warnings or failures. When the ALRM bit asserts, the AL LED does not assert, but the AL LED latches.

The PF LED illuminates if any pending failure bits routed to an output contact assert.

If the relay asserts the 86BF TRIP output, the A, B, or C targets latch to indicate the failed breaker pole.

The 52A and MOD LEDs illuminate if the associated rear-panel input is asserted.

Target LEDs illuminated during the last trip output stay lit until one of the following occurs:

- Operator presses front-panel TARGET RESET button
- Operator executes TARGET R command

The relay does not clear the targets when additional trip outputs occur. New and old tripping targets are displayed in a cumulative fashion until an operator clears them as described above.

TIME CLOCK SYNCHRONIZATION (IRIG-B)

The SEL-2BFR Relay accepts a demodulated IRIG-B formal signal of synchronizing its internal clock to an external source.

INSTALLATION

AC Connections

To effectively protect a power circuit breaker that includes tripping or closing resistors, the SEL-2BFR Relay must measure current flowing through each breaker pole and voltage drop across it. Figure 2 shows ac current and voltage inputs to the relay.

Apply current to the relay from current transformers on each phase of the protected breaker. The relay calculates voltage drop across each phase breaker by measuring the difference voltage between the secondaries of potential transformers connected on both sides of the protected breaker.

If you do not wish to use voltage-based breaker protection features such as resistor thermal protection, flashover protection, and breaker voltage warning, you need not connect the voltage inputs.

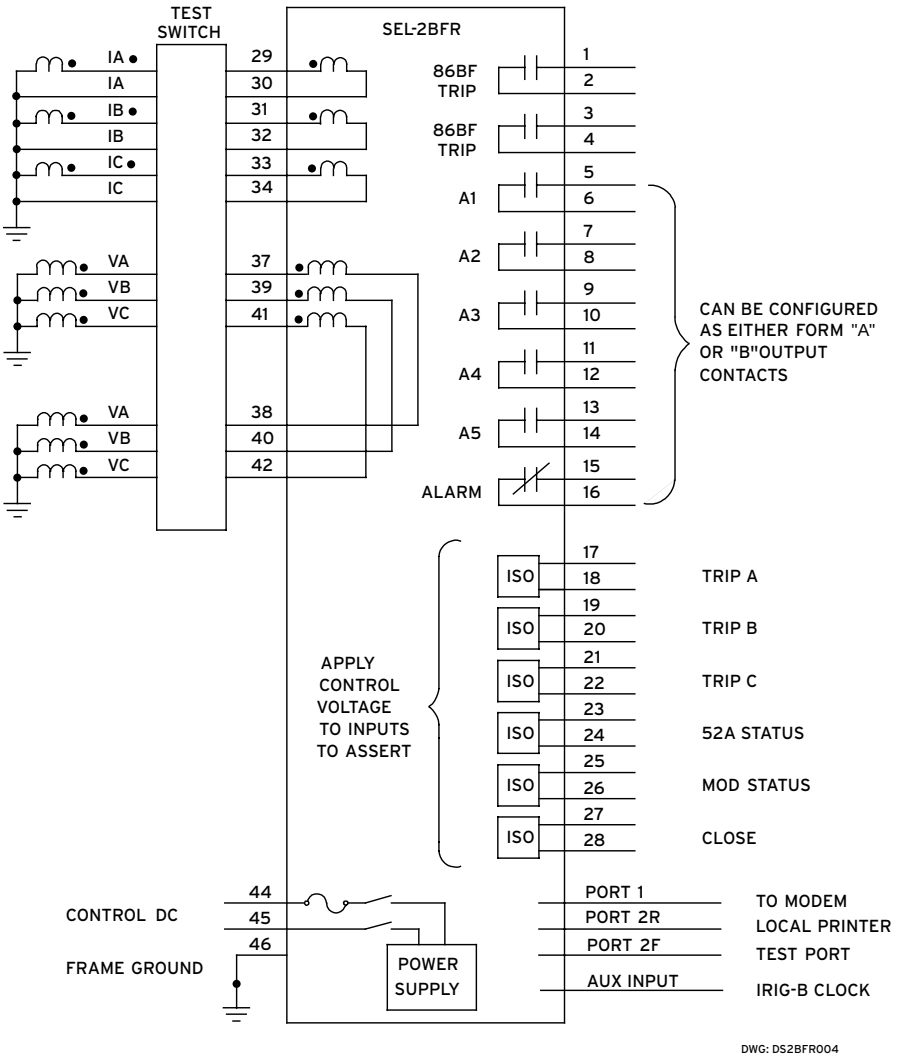

Figure 2: Example AC Input Connections

DC CONNECTIONS

Figure 3 and Figure 4 show dc connections to the relay for an example protection scheme. When you use the relay in a single-pole tripping scheme, consider wiring single-pole breaker auxiliary contacts in series for connection to the SEL-2BFR Relay 52A input.

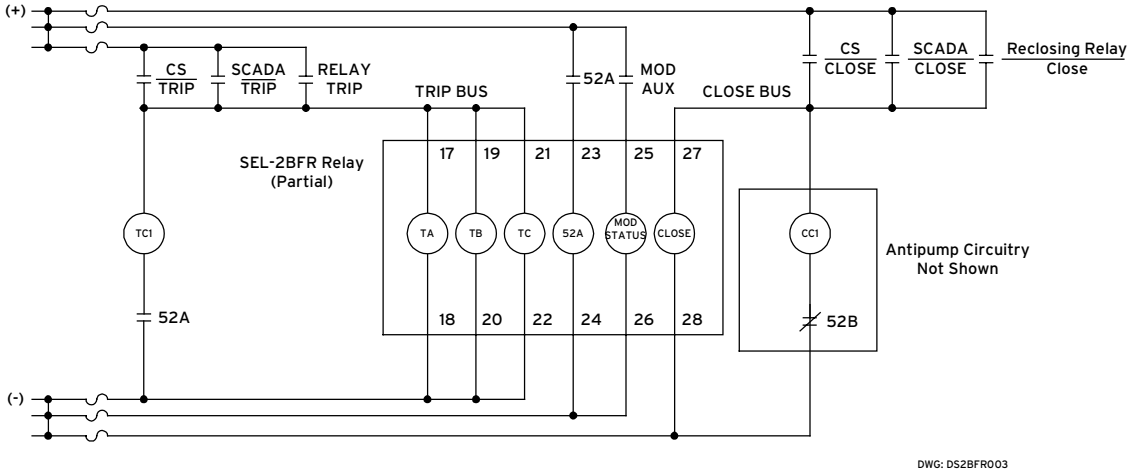

Figure 3: Example DC Input Connections

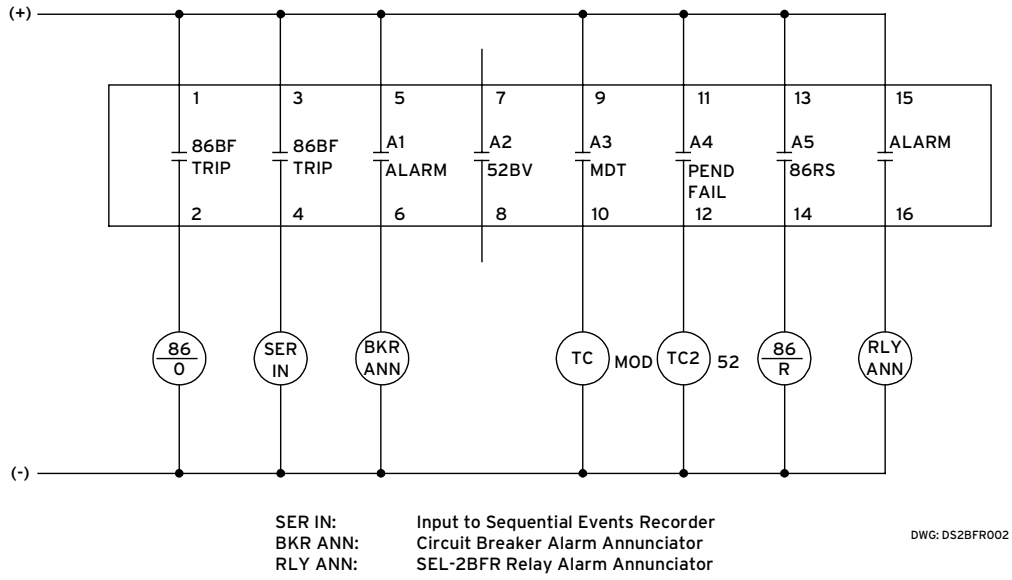

Figure 4: Example Contact Output Connections

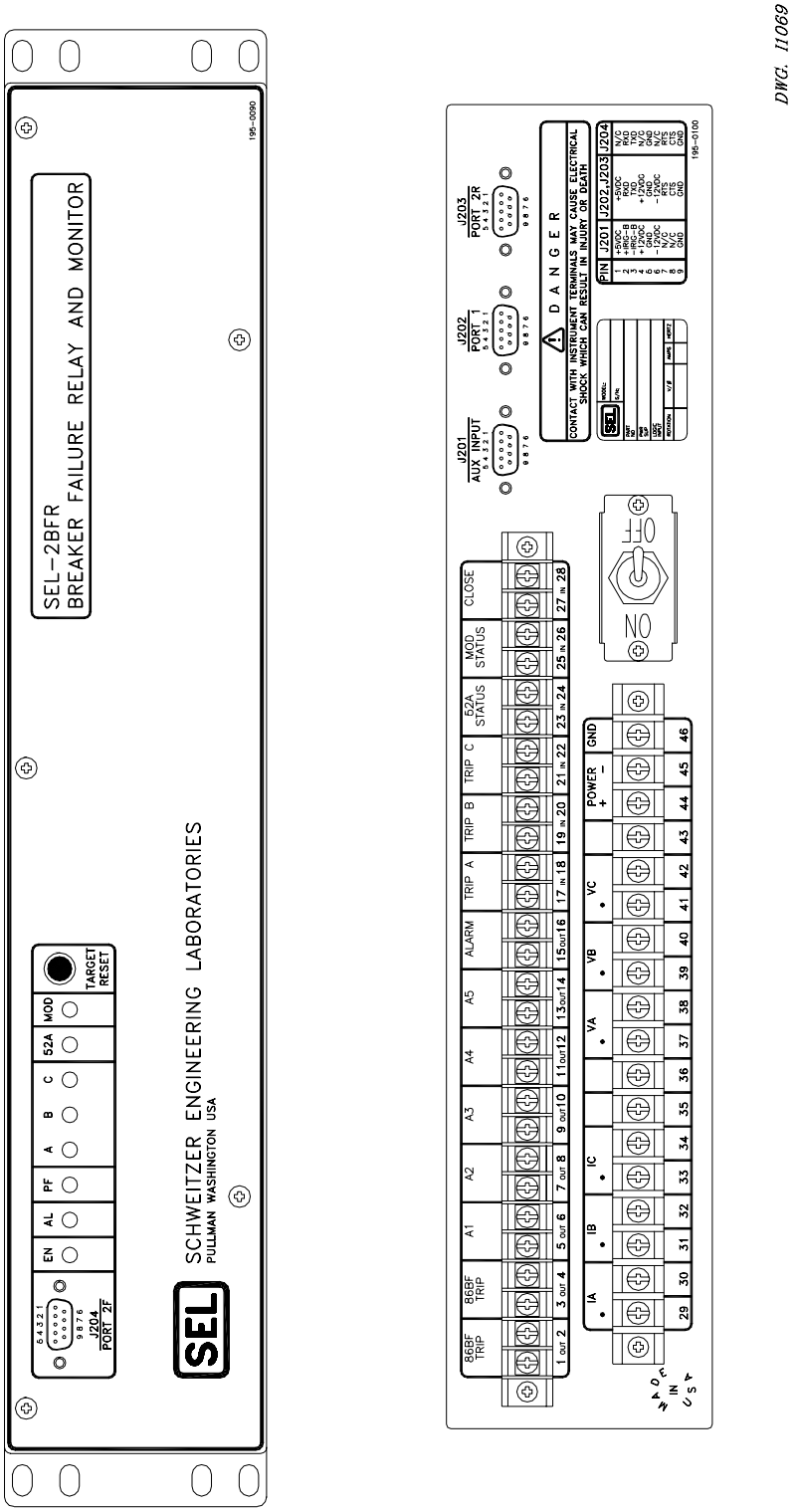

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Figure 5: SEL-2BFR Relay Front and Rear Panels

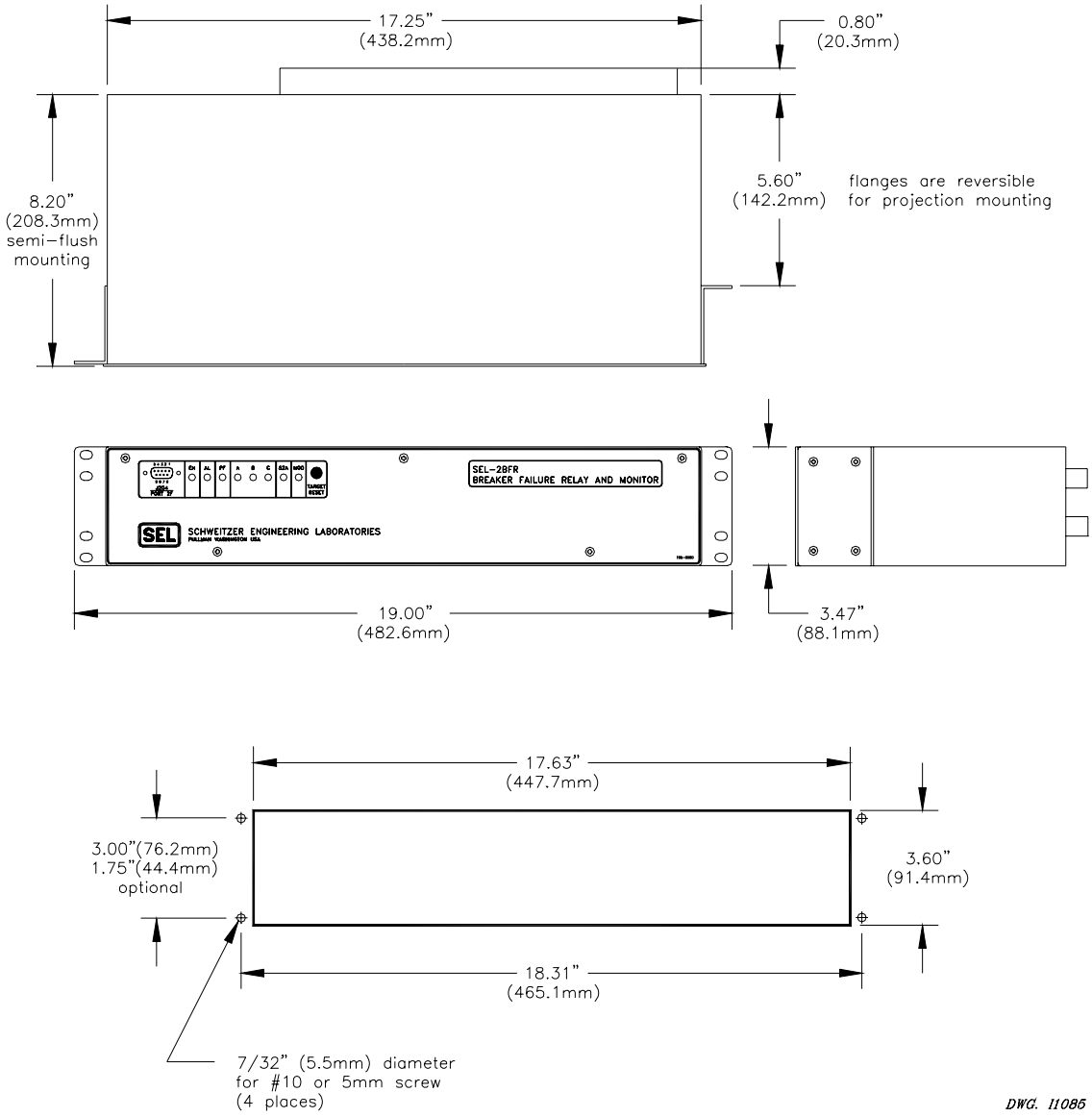

Figure 6: Relay Dimensions, Panel Cutout, and Drill Plan

GENERAL SPECIFICATIONS

AC Voltage Inputs
0 – 150 Vac line-to-neutral

AC Current Inputs

5 A Version	1 A Version
15 A per phase continuous	3 A per phase continuous
500 A for 1 s thermal rating	100 A for 1 s thermal rating

Rated Burden

Current Inputs 5 A Version	Current Inputs 1 A Version	Voltage Inputs
0.27 VA @ 5 A	0.06 VA @ 1 A	0.13 VA @ 67 V
2.51 VA @ 15 A	0.50 VA @ 3 A	0.45 VA @ 120 V

Optoisolated Input Ratings
24 Vdc: 15 – 30 Vdc
48 Vdc: 30 – 60 Vdc
125 Vdc: 80 – 150 Vdc
250 Vdc: 150 – 300 Vdc
Current = 4 mA at nominal voltage

Contact Outputs
30 A make per IEEE C37.90 para 6.6.2
6 A carry continuously; MOV protection provided

Power Supply
24/48 Volt: 20 – 60 Vdc; 125/250 Volt: 85 – 350 Vdc or 85 – 264 Vac
12 W

Communications
Two EIA-232 serial communications ports; Port 2 of the SEL-2BFR Relay has front- and rear-panel connectors

Time Code Input
Relay accepts demodulated IRIG-B time code

Dimensions
3.47" x 19.00" x 9.00" (8.81 cm x 48.26 cm x 22.86 cm) (H x W x D)
Depth (D) is to end of the rear-panel terminal blocks

Mounting
Available in horizontal or vertical mounting configurations

Dielectric Strength
V, I inputs: 2500 Vac for 10 s
Other: 3000 Vdc for 10 s (excludes EIA-232)
Routine tested

Operating Temp.
-40º to +158ºF (-40º to +70ºC)

Environment
IEC 68-2-30 Temperature/Humidity Cycle Test – six day (type tested)

Interference Tests
IEEE C37.90 SWC Test (type tested)
IEC 255-6 Interference Test (type tested)
IEC 801-4 Electrical Fast Transient/Burst Test (type tested)

Impulse Tests
IEC 255-5 0.5 J, 5000 V Test (type tested)

RFI Tests
IEEE C37.90.2-199X (draft) Withstand Capability of Relay Systems to Radiated Electromagnetic Interface from Transceivers

Vibration and Shock Tests
IEC 255-21-1 and –2, Class 1 Test (type tested)

ESD Test
IEC 801-2 Electrostatic Discharge Test (type tested)

Unit Weight
12 lb (5.5 kg); shipping weight 17 lb (7.7 kg), including one instruction manual

FUNCTIONAL SPECIFICATIONS

Overcurrent Elements

50FT Fault Current Element
setting range.....0.50 – 45.00 A secondary (5 A relay)
.....0.10 – 9.00 A secondary (1 A relay)
pickup time .....less than 0.84 cycle at 2 multiples of pickup
dropout time.....less than 1.10 cycle
pickup and dropout .....±0.025 A secondary ±5% of setting
transient overreach (Scheme 6)..... 12% of setting

50MD MOD Current Element
setting range.....0.10 – 45.00 A secondary (5 A relay)
.....0.02 – 9.00 A secondary (1 A relay)
pickup time .....less than 1.10 cycle at 2 multiples of pickup
dropout time.....less than 1.55 cycle
pickup and dropout .....±0.025 A secondary ±5% of setting

50LD Load/Line-Charging Current Element
setting range.....0.10 – 45.00 A secondary (5 A relay)
.....0.02 – 9.00 A secondary (1 A relay)
pickup time .....less than 1.10 cycle at 2 multiples of pickup
dropout time.....less than 1.55 cycle
pickup and dropout .....±0.025 A secondary ±5% of setting

Overvoltage Elements

59FO Flashover Voltage Element
setting range..... 1.0 – 67.0 V secondary
pickup time .....less than 1.35 cycle
dropout time.....less than 1.55 cycle
pickup and dropout .....±0.09 V secondary ±5% of setting

47Q Negative-Sequence Overvoltage Element
setting range..... 2.0 – 170.0 V secondary
pickup time .....less than 1.35 cycle
dropout time.....less than 1.55 cycle
pickup and dropout .....±0.27 V secondary ±15% of setting

59H Flashover Voltage Element
fixed setting ..... 67.0 V secondary
pickup time .....less than 1.35 cycle
dropout time.....less than 1.55 cycle
pickup and dropout .....±3.5 V secondary

Vwarn Voltage Across Closed Breaker Element
setting range..... 0.5 – 7.5 V secondary
pickup time .....less than 3 seconds
pickup and dropout .....±0.09 V secondary ±5% of setting

Current Unbalance Element

87UB Phase Current Unbalance Element

87 UB detects phase discordance when the protected breaker closes. For example, A-phase is unbalanced if phase current is above the 50LD setting in one or more phases and:

$$|IA| < \left(|IA| + |IB| + |IC|\right) / \text{87UB setting}$$

where 87UB setting = 8, 16, 32, or 64.

Stabilization time ..... less than 1.35 cycle

Overpower Elements

37OP Breaker Overpower Element

setting range..... 0.10 – 3400.00 W secondary (5 A relay)
..... 0.02 – 680.00 W secondary (1 A relay)
pickup time .....less than 2.10 cycles
dropout time.....less than 3.00 cycles
maximum element error, secondary units:
±2.25 mW ±10.25% (measured input power)
±2.63% (measured voltage) ±9.45% (measured current)

Breaker Resistor Thermal Elements

26CF Close Resistor Failure Element
26CP Close Resistor Pending Failure Element
26TF Trip Resistor Failure Element
26TP Trip Resistor Pending Failure Element

setting range..... 0.01 – 1000.00 J secondary (5 A relay)
..... 0.002 – 200.000 J secondary (1 A relay)

Settable Timers

Failure to Trip
Flashover
Phase Discordance Close Input
Trip and Close Resistor Heating
Retrip, etc. Timers
setting ranges ..... 0.25 – 63.75 cycles in quarter-cycle steps
Phase Discordance Failure
Bus Clearing and MOD Operate Timers
setting range..... 0.25 – 16,383.75 cycles in quarter-cycle steps

Fixed Timers

62F1	Flashover Voltage Time Delayed Dropout Timer	5 cycles
62F2	Load Current Pickup Timer (Flashover Logic)	5 cycles
62F3	Trip or Close Dropout Timer (Flashover Logic)	6 cycles
62M3	86BF Reset Signal Duration Timer	60 cycles
62M4	86BF Reset Time Delay, MOD Logic Enabled	300 cycles

Note: All timers are crystal controlled. Any significant ambiguities in timing are due to pickup/dropout times of measuring elements, inputs, and outputs. However, the 62OP timer has an accuracy of plus or minus one-half cycle.

FACTORY ASSISTANCE

The employee-owners of Schweitzer Engineering Laboratories are dedicated to making electric power safer, more reliable, and more economical.

We appreciate your interest in SEL products, and we are committed to making sure you are satisfied. If you have any questions, please contact us at:

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SEL-2BFR Breaker Failure Relay and Monitor Date Code 20010207

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