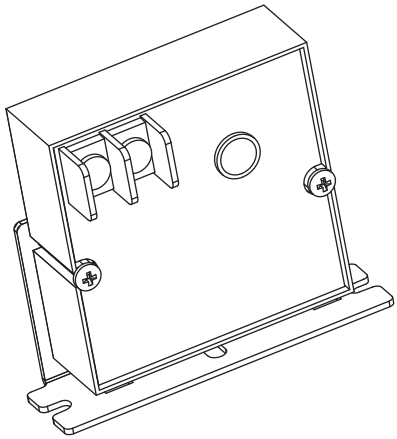
SEL-9502

Contact Arc Suppressor
Instruction Manual



Features and Benefits

The SEL-9502 Contact Arc Suppressor allows high-speed trip and close contacts to interrupt trip and close current without damage.

Protective relay output contacts are usually rated to interrupt limited dc current. For example, SEL rates standard output contacts to interrupt 0.3 A in a 125 Vdc circuit. The SEL-9502 allows standard output contacts in SEL relays or other equipment to interrupt up to 15 A in an inductive dc circuit.

Apply the SEL-9502 wherever a high-speed contact needs to safely, reliably, and repeatedly switch large, high-speed inductive dc loads.

- Interrupt up to 15 A in an inductive dc circuit up to 250 Vdc.
- Protect high-speed trip and close contacts from being damaged when they interrupt trip or close current due to a failed circuit breaker or malfunctioning auxiliary switch.
- Reduce maintenance on contacts subject to repetitive switching.

Safety Information

Dangers, Warnings, and Cautions

This manual uses three kinds of hazard statements, defined as follows:

⚠DANGER
Indicates an imminently hazardous situation that, if not avoided, **will** result in death or serious injury.

⚠WARNING
Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

⚠CAUTION
Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury or equipment damage.

Safety Symbols

The following symbols are often marked on SEL products.

	**⚠CAUTION** Refer to accompanying documents.	**⚠ATTENTION** Se reporter à la documentation.
	Earth (ground)	Terre
	Protective earth (ground)	Terre de protection
	Direct current	Courant continu
	Alternating current	Courant alternatif
	Both direct and alternating current	Courant continu et alternatif
	Instruction manual	Manuel d’instructions

Safety Marks

The following statements apply to this device.

General Safety Marks

Ambient air temperature shall not exceed 40°C (104°F).	La température ambiante de l'air ne doit pas dépasser 40°C (104°F).
Use a lead length of up to one foot between the unit and the contacts.	Utilisez une longueur de câble jusqu'à un pied entre l'unité et les contacts.
Terminal Ratings Tightening Torque Terminal Blocks: 1.7 Nm (15 in-lbs)	Valeurs nominales des bornes Couple de serrage Borniers : 1,7 Nm (15 livres-pouce)

Installing the SEL-9502

The SEL-9502 is self-powered and easy to install in new circuits or retrofit into existing installations.

Figure 1 shows how to connect the SEL-9502. The SEL-9502 connects to both sides of the protected contact to sense when the contact is open. The connection to the negative side of the contact is routed through a hole in the SEL-9502 so it can sense when load current is flowing through the contact.

The SEL-9502 is supplied with precrimped wires for ease of installation, or you can replace the supplied wire with your own.

Perform the following steps to install the SEL-9502:

Step 1. Use the supplied bracket to mount the SEL-9502 to any available surface, using the dimensions shown in *Figure 3*.

Mount the SEL-9502 close to the protected contact so that the leads connecting to the positive and negative terminal of the protected contact are as short as possible (bundle the two leads together).

NOTE: Keep the leads between the SEL-9502 and the protected contact as short as possible. This is important to the operation of the SEL-9502. The SEL-9502 protects a contact interrupting up to 15 A with a lead length of up to one foot between the SEL-9502 and the contacts. Longer leads will allow more contact arcing and damage, and might defeat arc suppression entirely.

Step 2. Connect the SEL-9502 across the contact, routing the connection to the negative terminal of the contact through the hole in the SEL-9502 (in either direction).

Step 3. Connect the load to the negative terminal of the SEL-9502.

The lead connecting the SEL-9502 to the switched load can be as long as necessary.

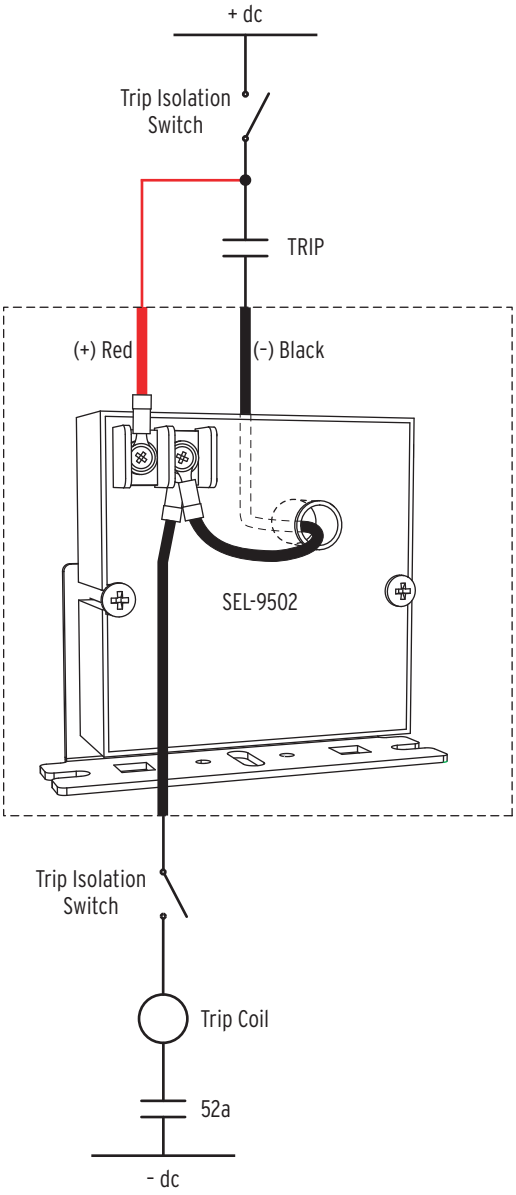


Figure 1 Typical SEL-9502 Installation

Application Guidelines

Low Load Current (Less Than One Amp)

To apply the SEL-9502 to circuits with load current less than 1 A, wrap the negative terminal lead through the hole in the SEL-9502 twice, as shown in *Figure 2*. Placing two turns through the current sense circuit of the SEL-9502 allows it to reliably sense currents as low as 0.4 Adc.

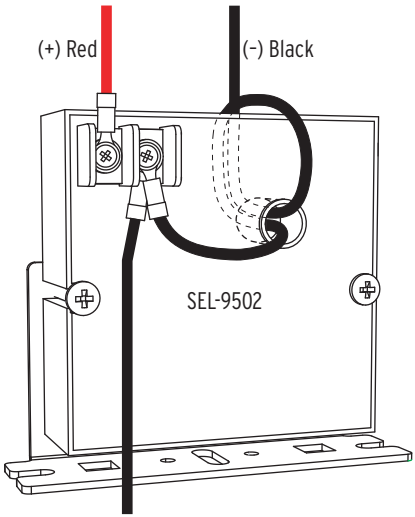


Figure 2 SEL-9502 Application With Load Current Less Than One Amp

⚠CAUTION
DO NOT place two turns on the SEL-9502 when applying it to loads larger than 2 A. This will degrade the ability of the SEL-9502 to protect the contacts.

Contact Condition and Series-Connected Contacts

Apply the SEL-9502 to clean contacts. Worn or burnt contacts may prevent the SEL-9502 from arming when the contacts are closed.

Existing installations may have several contacts connected in a series to help interrupt a dc current. Do not apply the SEL-9502 to series-connected contacts. Instead, use a single contact protected by the SEL-9502.

Lead Length and Parallel-Connected Contacts

The SEL-9502 can protect several parallel-connected contacts. Regardless of the number of contacts protected, the lead length from the SEL-9502 to the farthest protected contact must not exceed one foot. Route the connection from the SEL-9502 to the negative terminal of every protected contact through the hole in the SEL-9502.

Contact Separation Rate

Proper operation of the SEL-9502 requires “snap-acting” or spring-loaded contacts. When opening, the contacts must have sufficient physical separation after 2 ms to withstand 500 V. Most contacts meet this requirement, as a separation of even 1 mm easily withstands 500 V. Do not use the SEL-9502 to protect reed relays.

Many contacts are operated by electromechanical relay coils. These coils may have a suppression (or fly-back) diode placed across them to snub the switching transients that develop when the coil is de-energized. Such a snubbing diode can considerably slow contact separation. The SEL-9502 may not operate when applied to contacts with operating coils protected by suppression diodes. Replace the suppression diode with a metal oxide varistor or bipolar transient voltage suppressor. This allows the contacts to open quickly, but still suppresses unwanted transients.

Mechanical Diagram

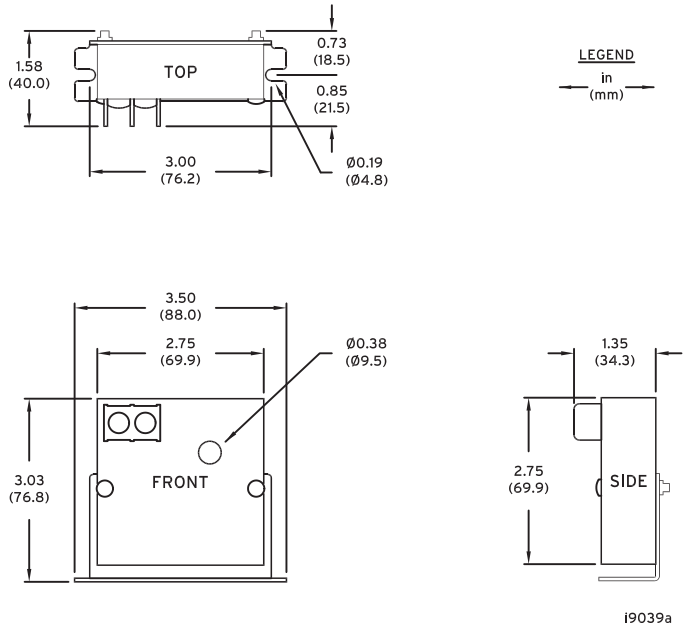


Figure 3 SEL-9502 Dimension Diagram

Arc Suppressor Operation (Patent Pending)

The SEL-9502 suppresses the arc that normally forms across contacts when they open while carrying dc current. When the SEL-9502 senses the contact is opening and is carrying current, it momentarily diverts the load current around the contact, allowing the contact to open with very little or no arcing. The SEL-9502 continues to divert load current around the parting contacts for 2 to 3 ms. It then interrupts the current and clamps any inductive kick or fly-back voltage to about 500 V, protecting the contacts from flashing over and reducing stress on wire insulation. The SEL-9502 dissipates the inductive circuit energy as heat, preventing the contacts from welding, melting, or even vaporizing.

Figure 4 shows the voltage across the protected contact and the current flowing through the load for a typical operation. When the contact is closed, the voltage across the contact is near zero and the current flowing through the load stabilizes at the steady state value. When the contacts open, the SEL-9502 detects a rapid voltage increase across the contacts. When the contact voltage increases, the SEL-9502 diverts current around the contact for less than 100 µs and limits the voltage increase across the contact. This causes

the current flowing through the contact to decrease. If the SEL-9502 senses that the current through the contacts drops, it continues to divert current around the opening contacts for another 2 to 3 ms, giving the contacts time to separate. The SEL-9502 then interrupts the current and clamps the contact voltage to about 500 V, forcing the current through the load to ramp to zero.

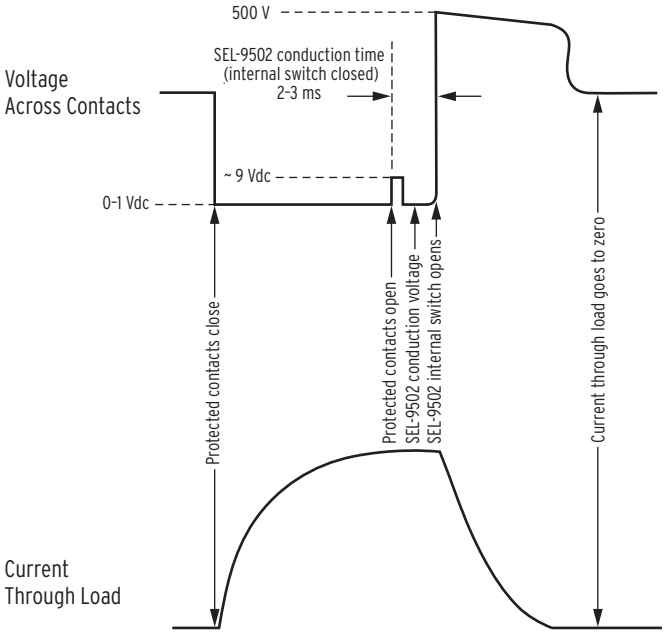


Figure 4 SEL-9502 Typical Operation Voltage and Current Waveforms

Figure 5 shows the voltage across the contact and the current through the load when the circuit is energized (e.g., when the last isolation switch in *Figure 1* closes). The SEL-9502 detects a rapid increase in voltage across the contact and allows current to flow around the contact. Since no current was flowing through the contact before the contact voltage increased, the SEL-9502 terminates the arc suppression operation after less than 100 µs. In other words, the SEL-9502 energizes the load for no more than 100 µs when the circuit is energized. After the circuit is energized, the SEL-9502 remains off even during transients in the dc control wiring. The SEL-9502 will never experience dv/dt induced operation or latch-up. It has been designed for the substation environment and does not use an SCR or a TRIAC.

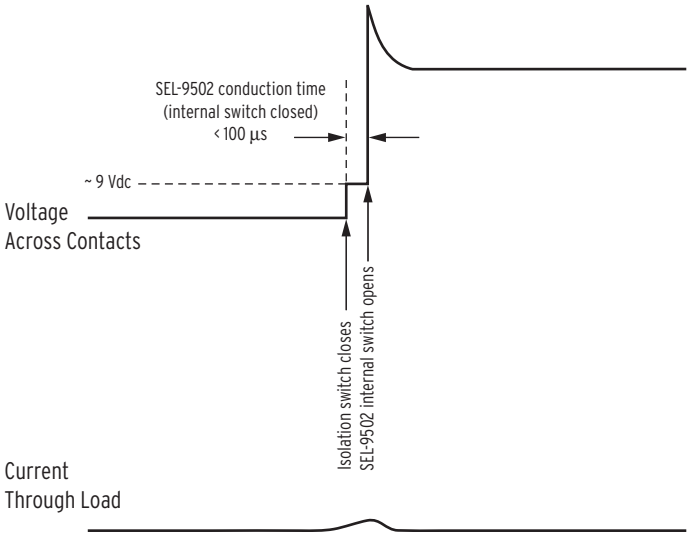


Figure 5 SEL-9502 Typical Let-Through Voltage and Current Waveforms

Specifications

Compliance

ISO 9001:2008 Certified
UL Registered to US and Canadian safety standards (File E202915; NKCR2, NKCR8)

Performance

Open Contact Voltage

40–280 Vdc

Breaking Capacity

15 Adc, L/R = 40 ms

Duty Cycle

60 cycles minimum delay between TRIP and CLOSE

Leakage Current

$I_{max} \leq 600$ µA for $0 < t \leq 37$ µs
$I_{max} \leq 180$ µA for 37 µs $< t$

Let-Through Duration

≤100 µs (See *Figure 5*)

Maximum Capacitance

1.5 nF across protected contact

Operating Temperature Range

–40° to +85°C
–40° to +185°F

Type Tests

Electromagnetic Compatibility

EN 50263:1999
IEC 61000-4-6, First Edition:1996
ENV 50204:1995

ESD

IEC 61000-4-2, First Edition:1995

Fast Transient/Burst Immunity

IEC 61000-4-4, First Edition:1995
IEC 60255-22-4, First Edition:1992

Radiated Frequency Immunity

IEC 60255-22-3, First Edition:2000
IEC 61000-4-3, First Edition:1998
IEEE C37.90.2

Surge Withstand

IEC 61000-4-5, First Edition:1995
IEC 60255-22-1, First Edition:1988
IEEE C37.90.1-1989
IEEE C37.90.1/D6

Environmental

IEC 60068-2-1, Fifth Edition:1990
IEC 60068-2-2, Fourth Edition:1974
IEC 60068-2-30, Second Edition:1980

Vibration

IEC 60255-21-1, First Edition:1988
IEC 60255-21-2, First Edition:1988
IEC 60255-21-3, First Edition:1993

Dielectric Strength

IEC 60255-5, Second Edition:2000
IEEE C37.90-1989
IEC 60255-5, First Edition:2000

Fire Hazard

IEC 60695-2-2, Second Edition:1991

Factory Assistance

We appreciate your interest in SEL products and services. If you have questions or comments, please contact us at:

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