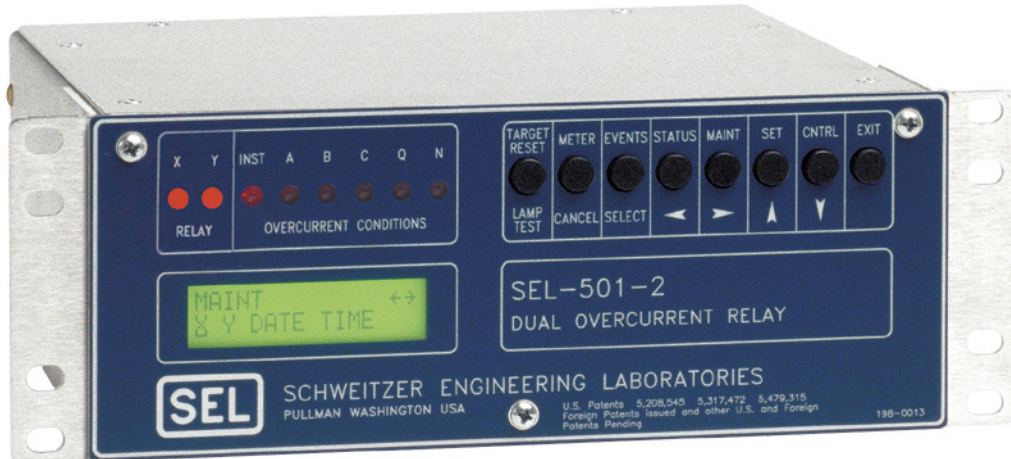




# SEL-501-2 Distribution Relay

## Dual Overcurrent Relay



## Major Features and Benefits

- Features two three-phase current-based relays in one compact package.
- Protects feeders, buses, and other apparatus.
- Is easily set from the front panel or communications port.
- Includes metering, self-testing, and event reporting.
- Saves 2 full reports and 20 summaries in nonvolatile memory.
- Makes redundant protection practical—ideal for stacked breaker switchgear.
- Includes low-level test interface.
- Supports ASCII, SEL LMD, and Modbus protocol.

# Features

## Dual Relay Concept

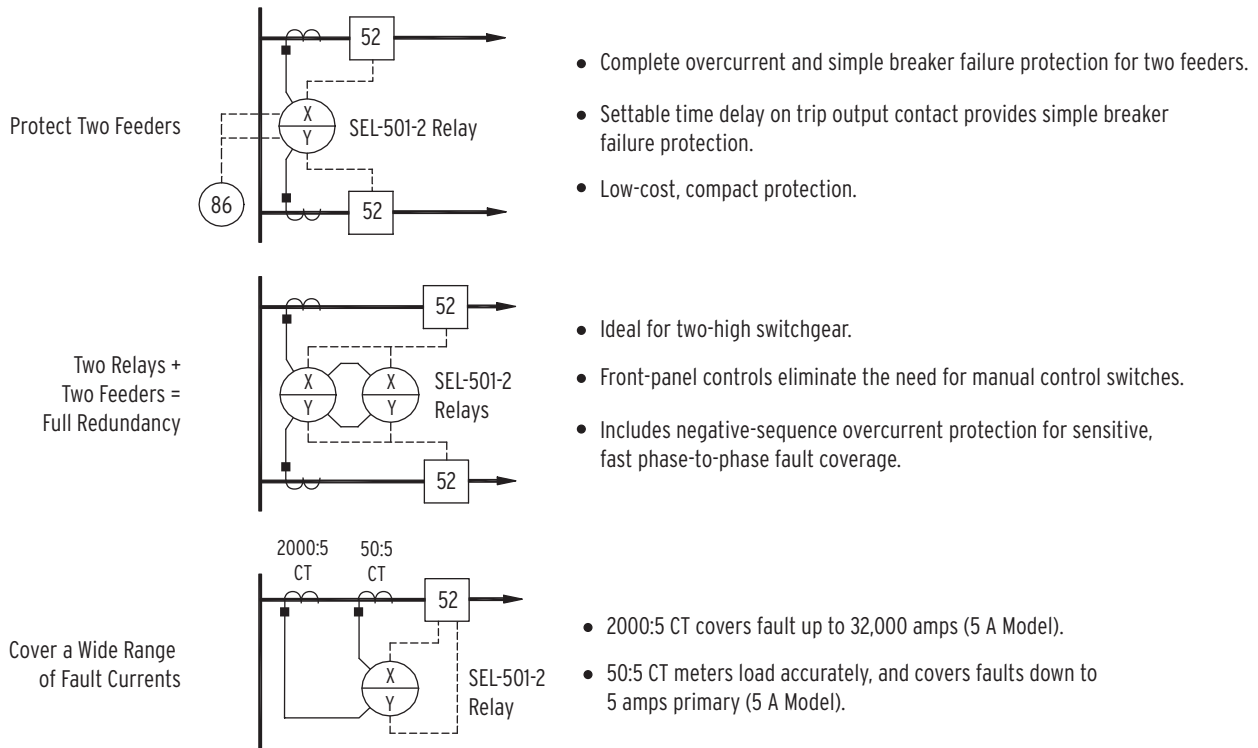
The SEL-501-2 Dual Overcurrent Relay provides two complete and independent groups of protection functions in one compact unit. The unit contains Relay X and Relay Y, each having separate optoisolated inputs, output contacts, and three-phase current inputs.

**Table 1 Inputs and Outputs for Relays X and Y**

	Input	Output Contacts	Current Inputs
<b>Relay X</b>	XIN	XOUT1, XOUT2	IAX, IBX, ICX
<b>Relay Y</b>	YIN	YOUT1, YOUT2	IAY, IBY, ICY

Select the relay functions independently for Relays X and Y.

## SEL-501-2 Dual Relay Applications



**Figure 1 Example SEL-501-2 Dual Relay Applications**

## Overcurrent Element Specifications

**Table 2 Overcurrent Element Specifications**

	Instantaneous Elements	Definite-Time Elements	Inverse-Time Elements
Phase (Ia, Ib, and Ic)	50H	50PT	51PT
Negative-Sequence ( $I_Q = 3 \cdot I_2$ )		50QT	51QT
Residual ( $I_R = I_a + I_b + I_c$ )	50NH	50NT	51NT
Pickup Ranges (A secondary)			
5 A Model:	0.5–80 A, 0.1 step	0.5–80 A, 0.1 step	0.5–16 A, 0.1 step
1 A Model:	0.1–16 A, 0.1 step	0.1–16 A, 0.1 step	0.1–3.2 A, 0.1 step
Definite-Time Delay		0–16,000 cycles	U.S. and IEC curves

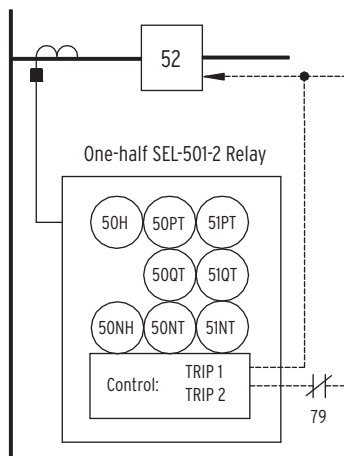


Figure 2 Relay Application Single-Line Diagram

## Relay Control Functions

Control the SEL-501-2 overcurrent elements with either the optoisolated input IN or serial port remote bit RB. Any given overcurrent element can be enabled/blocked by the optoisolated input IN or remote bit RB, but not by both at the same time.

### Relay Control by Input IN

Program input IN to function as one of the following:

IN = EN	EN—Enable user-selected elements
IN = BLK	BLK—Block user-selected elements
IN = ET	ET—External Trigger of event reports

### Relay Control by Remote Bit RB

Program individual overcurrent elements for control by remote bit RB. Enable/disable the specified overcurrent elements by deasserting/asserting remote bit RB via serial port command.

### Relay Output Contact Functions

- TRIP1 (OUT1)—select any overcurrent elements
- TRIP2 (OUT2)—select any overcurrent elements

Both trips have time-delayed pickup timers, settable 0–16,000 cycles.

## Operation, Metering, and Communications

- Complete operation from front-panel controls, front-panel serial port, or rear-panel serial port
- Full access to event history, relay status, and meter information
- Metering of instantaneous, demand, and peak demand currents
- Passcode protection of settings and control
- Modbus RTU protocol support for direct integration, via appropriate gateways, into SCADA or DCS systems

## Event Reporting

The SEL-501-2 saves a 15-cycle event report each time the OUT1 or OUT2 output contact closes, or when any of several protection elements pick up for Relay X or Relay Y. Each event report contains detailed current, relay element, input, and output data associated with the event. Use the information contained in the relay event reports to review relay operation during faults and tests.

The relay stores event summaries for the 20 latest events and full-length reports for the 12 latest events.

### Event Triggering

The relay generates an event report when any of the following occurs:

- Serial port **TRIGGER** command is executed
- Relay X or Relay Y issues a trip
- Definite-time or inverse-time overcurrent element triggers

The relay generates a second report for a single fault if either relay trips after the end of the initial report. This allows the relay to record the inception and clearance of faults.

### Event Summary

Each time the relay generates an event report, it also generates an event summary. Event summaries contain the following information:

- Relay X and Relay Y identifier strings
- Date and time when the event was triggered
- Event type and duration
- Tripping targets for the relay that triggered the event
- Current magnitudes measured by Relay X and Relay Y at the trigger instant

EXAMPLE FD Date: 06/02/97 Time: 16:04:50.541 Time tag corresponds to the eighth quarter-cycle of this event.

FID=SEL-501-2-R100-V65X1XXpa-D950426

IRX	Relay X			ICX	IRY	Relay Y			Relay X		Relay Y		A
	IAX	IBX	Pri			IAY	IBY	Pri	555555	0 555555	0 L	IU R	
-2	86	206	-294	-0	124	208	-332	.....	..	.....	..	..	
-0	-288	220	68	-3	-313	265	46	.....	..	.....	..	..	
0	-86	-206	292	-1	-125	-207	331	.....	..	.....	..	..	
0	288	-220	-67	2	313	-265	-46	.....	..	.....	..	..	
-2	86	205	-293	1	126	206	-332	.....	..	.....	..	..	
-2	-288	220	66	-4	-314	265	46	.....	..	.....	..	..	
2	-87	-206	294	-2	-126	-207	331	.....	..	.....	..	..	
-480	-191	-220	-69	-42	270	-265	-47	.....	..	.....	..	..	
1203	1291	206	-295	11	136	206	-332	p.n...	..	.....	..	..	
584	297	219	69	124	-188	265	48	p.n...	..	.....	..	..	
-2758	-2846	-207	294	-27	-152	-207	331	p.n...	..	.....	..	..	
-215	73	-219	-69	-165	149	-265	-48	p.n...	..	.....	..	..	
3110	3199	206	-295	32	157	206	-332	p.np.H	.b	.....	..	..	
213	-75	219	69	164	-148	265	47	p.np.H	.b	.....	..	..	
-3114	-3200	-207	294	-34	-157	-208	331	pqp.H	.b	.....	..	..	
-210	77	-219	-68	-164	149	-265	-47	pqp.H	.b	.....	..	..	
[Four cycles of data]													
1910	1956	130	-176	21	147	208	-334	pqn.qn	.b	.....	..	..	
-372	-458	27	58	37	-277	264	50	pqn.qn	.b	.....	..	..	
-350	-352	-28	30	-7	-131	-209	332	..n...	.b	.....	..	..	
0	0	0	0	2	315	-264	-50	..n...	.b	.....	..	..	
[Six cycles of data]													
Event: FAULT X Targets: X INST A N Duration: 7.25													
Relay X Currents (A Pri), ABCQN: 210 301 302 479 481													
Relay Y Currents (A Pri), ABCQN: 298 336 334 40 42													
Relay X Settings:													
ID = EXAMPLE FD													
CTR = 120 DATC = 5 IN = ET													
50PP = 25.0 50PD = 20.00 50PTT = B													
50H = 40.0 50HT = B													
50QP = 15.0 50QD = 20.00 50QTT = B													
50NP = 15.0 50ND = 20.00 50NTT = B													
50NH = 25.0 50NHT = B													
51PP = 6.00 51PC = U3 51PTD = 3.00													
51PRS = Y 51PTT = B													
51QP = 6.00 51QC = U3 51QTD = 3.00													
51QRS = Y 51QTT = B													
51NP = 1.50 51NC = U3 51NTD = 3.00													
51NRS = Y 51NTT = B													
TRPU1 = 0.00 TDUR1 = 6.00													
TRPU2 = 0.00 TDUR2 = 6.00													
ELTCH = Y													
IN: External Trigger													
TRIP1: 51PT, 51QT, 51NT, 50PT, 50H, 50QT, 50NT, 50NH													
TRIP2: 51PT, 51QT, 51NT, 50PT, 50H, 50QT, 50NT, 50NH													
Relay Y Settings: [similar to Relay X settings, above]													

One cycle of data

Relay X 51N element picks up, triggering this report

Relay X 51P, 51N, 50P, and 50N elements are picked up. The 50NH element picks up, causing a trip. Elements XOUT1 and XOUT2 both close.

Breaker operates, clearing the fault.

Event Summary

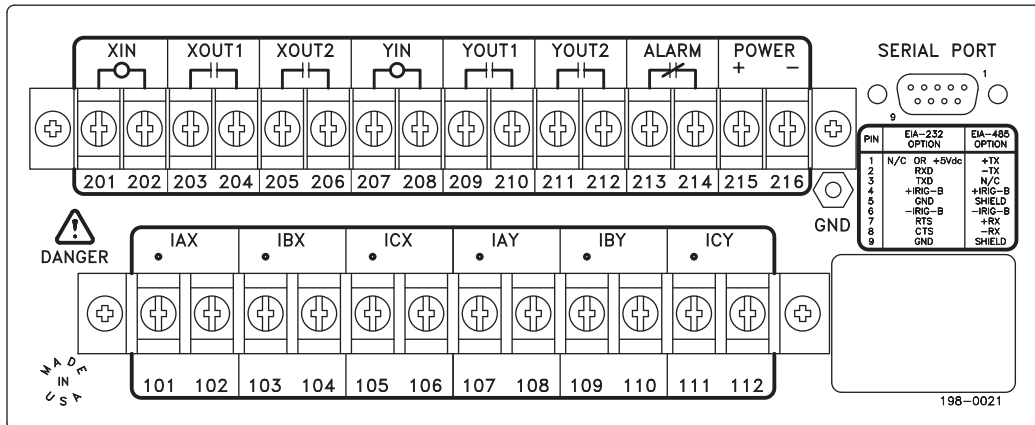
Relay X Settings

Input and output function summary, defined by relay settings.

Figure 3 Example Event Report

# Rear-Panel Options

## Conventional Terminal Blocks



i3031a

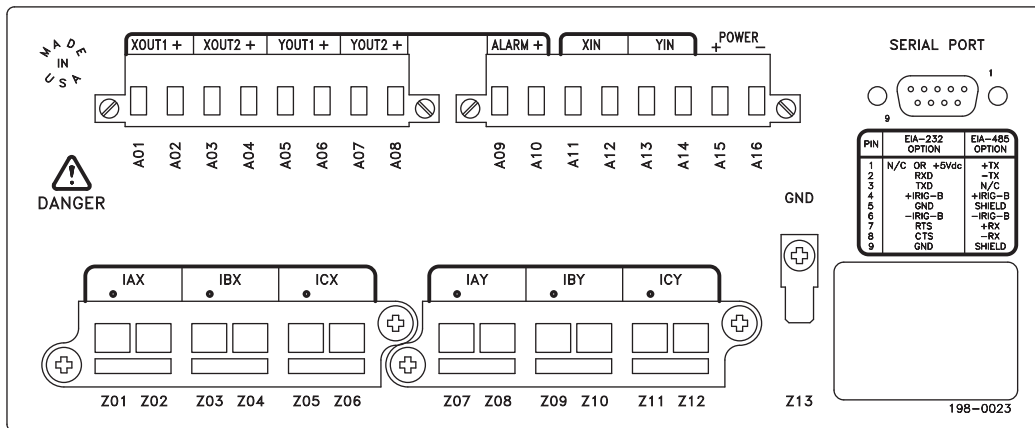
**Figure 4 SEL-501-2 Relay Without Front Serial Port Rear Panel (Conventional Terminal Blocks Option)**

Output contacts XOUT1, XOUT2, YOUT1, YOUT2, and ALARM are not polarity-dependent.

Optoisolated inputs XIN and YIN are not polarity-dependent.

All screws are size #6-32.

## Connectorized Relay (Plug-In Connectors)



i3034a

**Figure 5 SEL-501-2 Relay Rear Panel (Plug-In Connectors Option)**

**Important:** Improvements in Connectorized<sup>®</sup> SEL-501-2 relays (Plug-In Connectors) resulted in part number changes.

The respective wiring harness part numbers for these old and new Connectorized SEL-501-2 relays are (partial part number shown):

The current transformer shorting connectors for current channel inputs IAX, IBX, ICX, and IAY, IBY, ICY have been made more robust. This improvement makes the new connector design incompatible with the old design. Thus, new Connectorized SEL-501-2 relays with this improved connector have a new part number (partial part number shown).

Old	New
WA0501xJ	WA0501xW

Figure 5 shows the rear panel for new models 0501xW. Because all terminal/numbering remains the same between the new and old relays, these figures can be used as a reference for old model 0501xJ. Only the connectors and part numbers have changed.

Old	New
0501xJ	0501xW

Connector terminals A01–A16 accept wire size AWG 24 to 12 (install wires with a small slotted screwdriver).

Output contacts XOUT1, XOUT2, YOUT1, YOUT2, and ALARM are polarity-dependent (note the + above terminals A02, A04, A06, A08, and A10).

See *Specifications* for high-current interrupting output contact ratings.

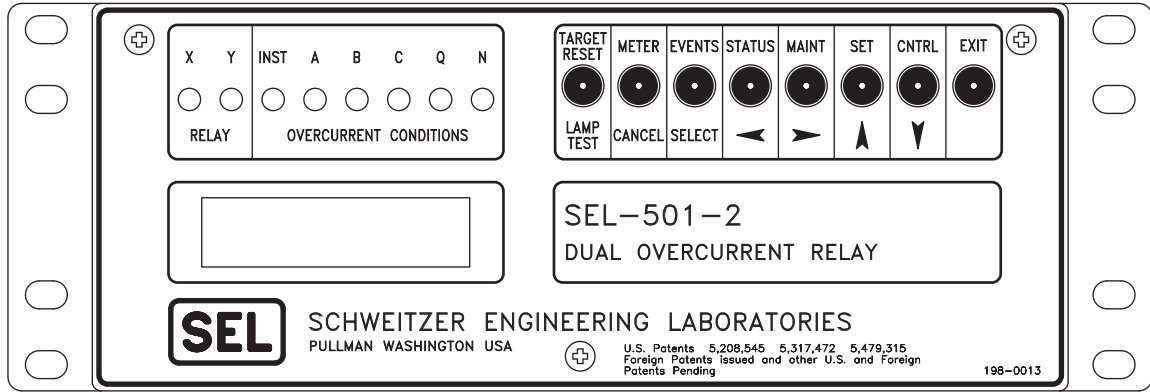
Optoisolated inputs XIN and YIN are not polarity-dependent.

Current input connectors (terminals Z01–Z12):

- Contains current transformer shorting mechanisms
- Accepts wire size AWG 16 to 10 (special tool required to attach wire to connector)
- Can be ordered prewired

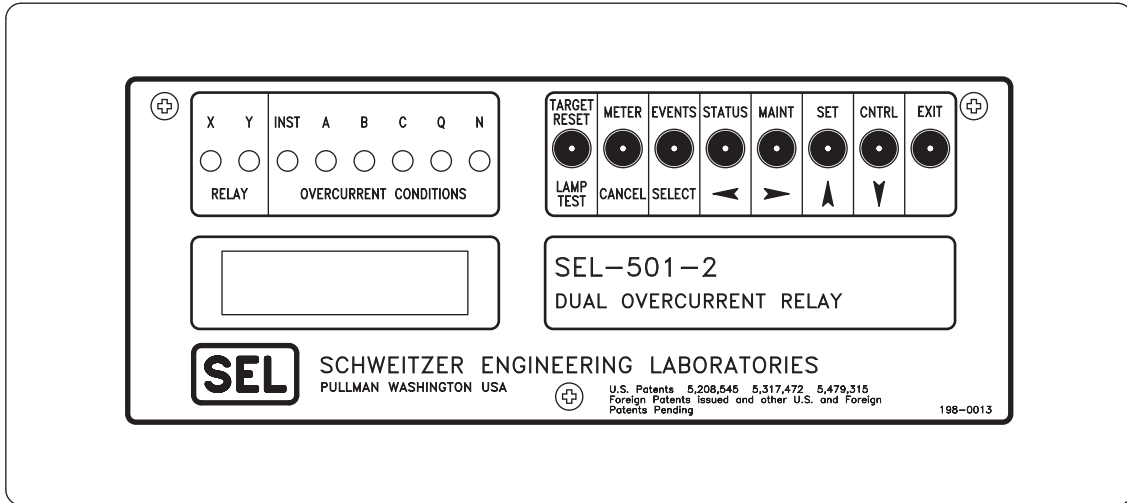
Ground connection (terminal Z13): tab size 0.250 inch x 0.032 inch, screw size #6-32.

# Front- and Rear-Panel Diagrams



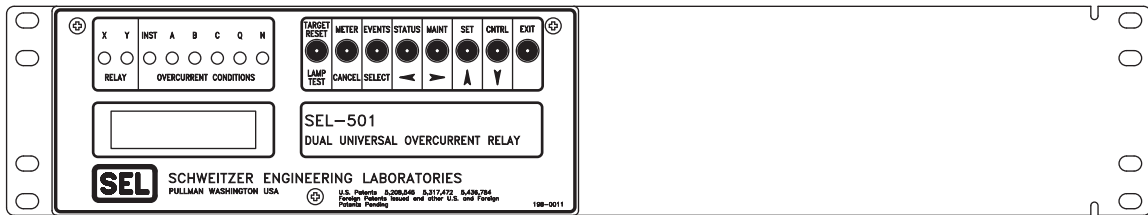
SEL-501-2 Relay, Rack-Mount Version (Half-Rack Width)

i3029a



SEL-501-2 Relay Front Panel, Panel-Mount Version

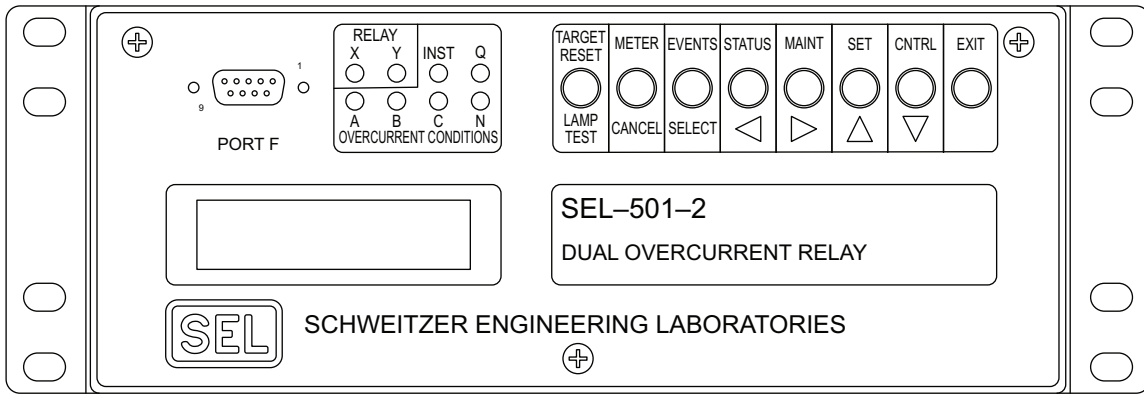
i3030a



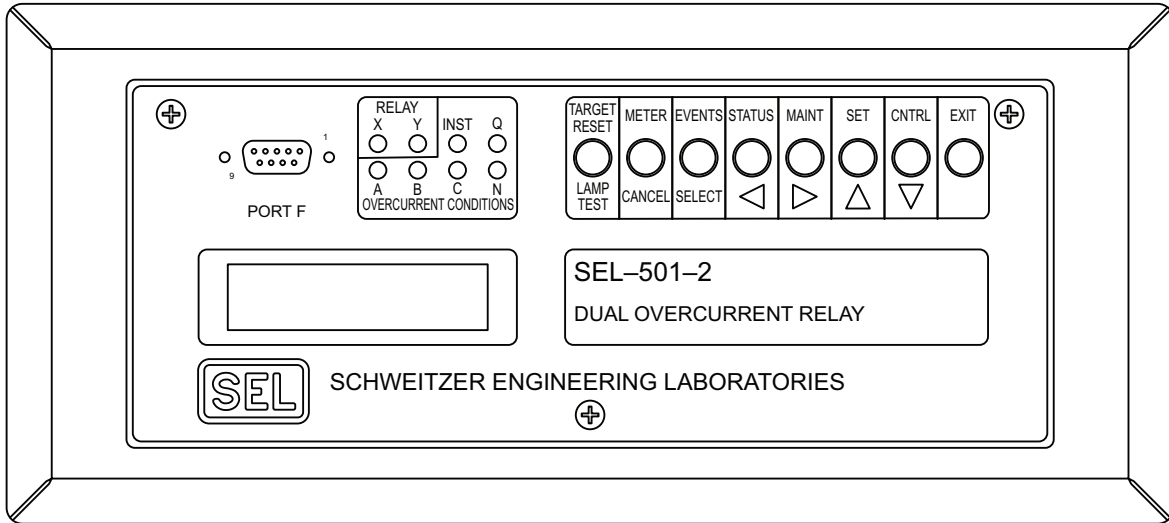
SEL-501-2 Relay Fitted With Mounting Bracket (SEL P/N 9100) for Mounting in 19-inch Rack

i3032a

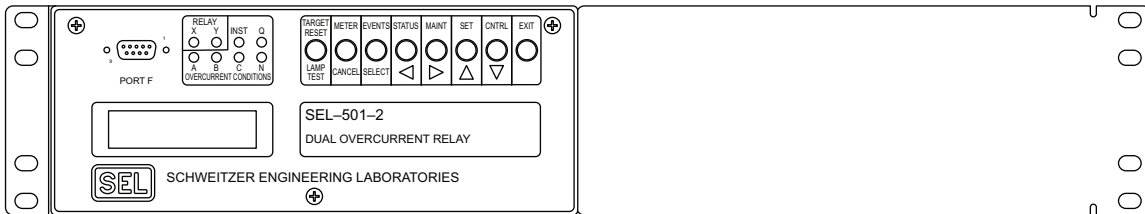
**Figure 6 SEL-501-2 Front Panels Without Front Serial Port**



SEL-501-2 Relay, Rack-Mount Version (Half-Rack Width)



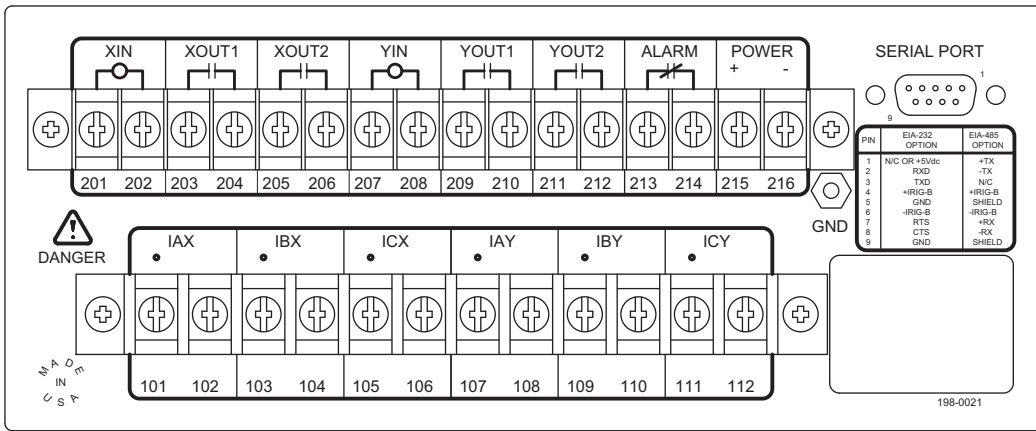
SEL-501-2 Relay Front Panel, Panel-Mount Version



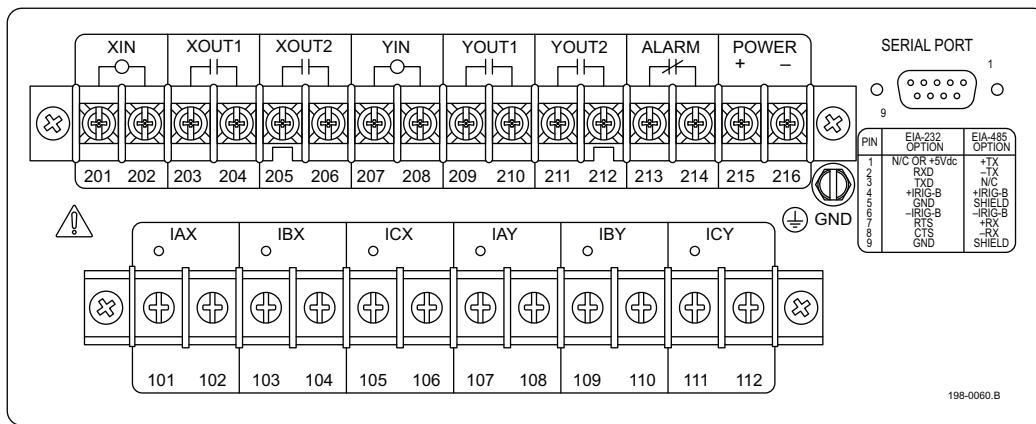
SEL-501-2 Relay Fitted With Mounting Bracket (SEL P/N 9100) for Mounting in 19-inch Rack

**Figure 7 SEL-501-2 Front Panels With Front Serial Port**

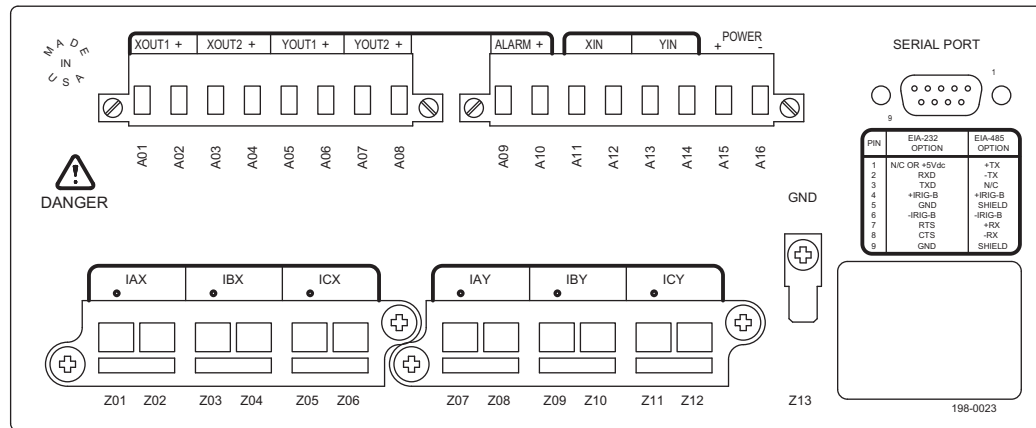




SEL-501-2 Relay Without Front Serial Port Rear Panel (Conventional Terminal Blocks Option)



SEL-501-2 Relay With Front Serial Port Rear Panel (Conventional Terminal Blocks Option)

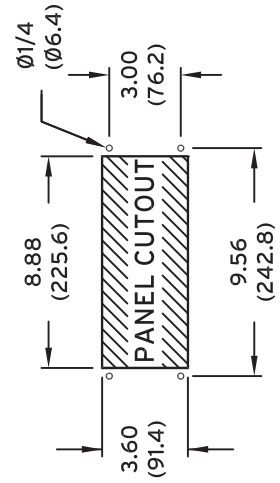
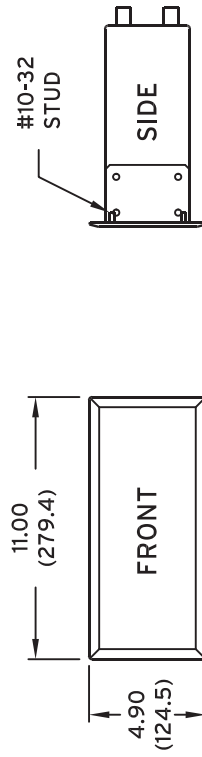
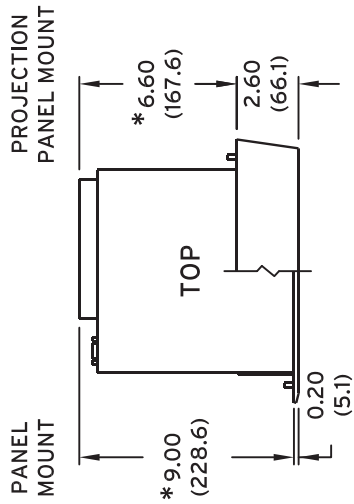


SEL-501-2 Relay Rear Panel (Plug-In Connectors Option)

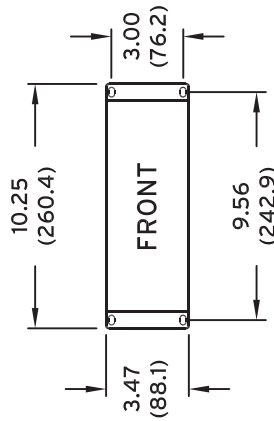
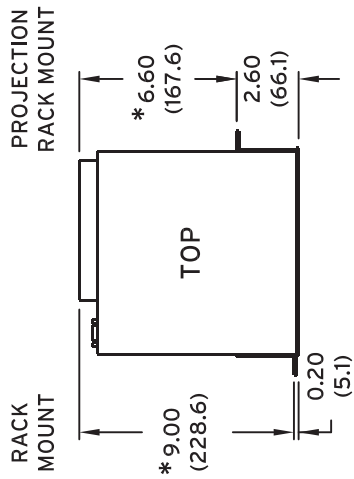
Figure 8 SEL-501-2 Rear-Panel Diagrams

# Relay Dimensions

## PANEL-MOUNT CHASSIS



## RACK-MOUNT CHASSIS

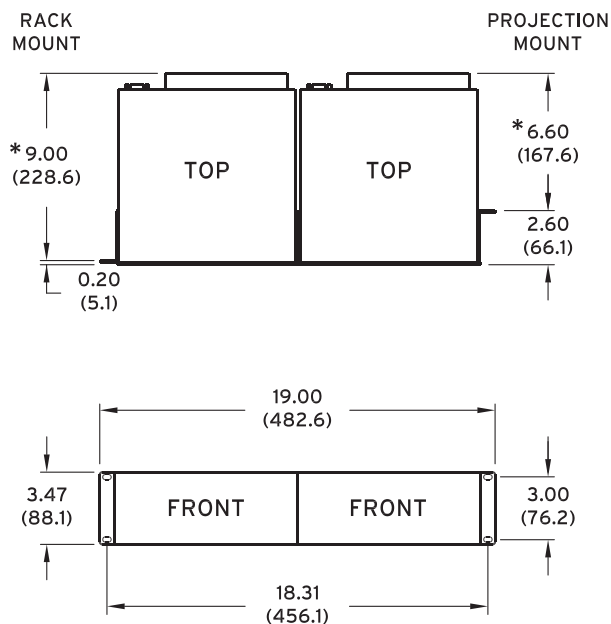


\* ADD 0.80 (20.3) FOR CONNECTORIZED RELAYS

i9011b

Figure 9 SEL-501-2 Dimensions for Rack- and Panel-Mount Models

### RACK-MOUNT CHASSIS



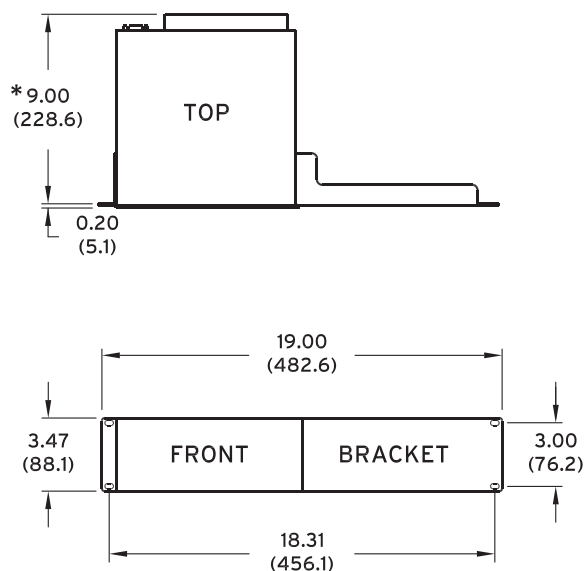
LEGEND  
 in  
 (mm)

\* ADD 0.80 (20.3) FOR CONNECTORIZED RELAYS

i9024b

**Figure 10 Relay Dimensions and Drill Plan for Mounting Two SEL-500 Series Relays Together Using Mounting Block (SEL P/N 9101)**

### RACK-MOUNT CHASSIS



LEGEND  
 in  
 (mm)

\* ADD 0.80 (20.3) FOR CONNECTORIZED RELAYS

i9028a

**Figure 11 Relay Dimensions and Drill Plan for Mounting an SEL-501-2 Relay With Rack-Mount Bracket 9100 (bracket on right side front view)**

# Specifications

## Compliance

Designed and manufactured under an ISO 9001 certified quality management system

UL Listed to US and Canadian safety standards (File E212775; NRGU, NRGU7)

CE Mark

UKCA Mark

RCM Mark

**Note:** This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

## General

### Terminal Connections

Terminals or stranded copper wire. Ring terminals are recommended. Minimum temperature rating of 105°C.

### Tightening Torque

#### Terminal Block

Minimum:	1.1 Nm (9-in-lb)
Maximum:	1.3 Nm (12-in-lb)

#### Connectorized

Minimum:	0.6 Nm (5-in-lb)
Maximum:	0.8 Nm (7-in-lb)

### AC Current Inputs

5 A Nominal:	15 A continuous, 500 A for 1 s, linear to 100 A symmetrical. 625 A for 1 cycle (sinusoidal waveform)
Burden:	0.16 VA at 5 A 1.15 VA at 15 A
1 A Nominal:	3 A continuous, 100 A for 1 s, linear to 20 A symmetrical. 250 A for 1 cycle (sinusoidal waveform)
Burden:	0.06 VA at 1 A 0.18 VA at 3 A

**Note:** 60/50 Hz system frequency and ABC/ACB phase rotation are ordering options.

### Power Supply

#### 125/250 Vdc or Vac

Range:	85–350 Vdc or 85–264 Vac
Burden:	<5.5 W
Interruption:	100 ms at 250 Vdc
Ripple:	100%

#### 48/125 Vdc or 125 Vac

Range:	36–200 Vdc or 85–140 Vac
Burden:	<5.5 W
Interruption:	100 ms at 125 Vdc
Ripple:	5%

#### 24 Vdc

Range:	16–36 Vdc polarity-dependent
Burden:	<5.5 W

Interruption: 25 ms at 36 Vdc

Ripple: 5%

**Note:** Interruption and Ripple per IEC 60255-11:1979.

### Output Contacts

The output type is dependent on the rear-panel terminal type. Output ratings were determined with IEC 60255-0-20:1974, using the simplified method of assessment.

#### Standard (Conventional Terminal Blocks Option)

Make:	30 A	
Carry:	6 A continuous carry	
1 s Rating:	100 A	
MOV Protection:	270 Vac/360 Vdc	
Pickup Time:	<5 ms	
Dropout Time:	<5 ms	
Breaking Capacity (10000 operations)		
24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

#### Cyclic Capacity (2.5 cycle/second)

24 V	0.75 A	L/R = 40 ms
48 V	0.50 A	L/R = 40 ms
125 V	0.30 A	L/R = 40 ms
250 V	0.20 A	L/R = 40 ms

#### High-Current Interrupting (Plug-In Connectors Option)

Make:	30 A	
Carry:	6 A continuous carry	
MOV Protection:	330 Vdc	
Pickup Time:	<5 ms	
Dropout Time:	<8 ms, typical	

#### Breaking Capacity (10000 operations)

24 V	10.0 A	L/R = 40 ms
48 V	10.0 A	L/R = 40 ms
125 V	10.0 A	L/R = 40 ms
250 V	10.0 A	L/R = 20 ms

#### Cyclic Capacity (4 cycles in 1 second followed by 2 minutes idle for thermal dissipation)

24 V	10.0 A	L/R = 40 ms
48 V	10.0 A	L/R = 40 ms
125 V	10.0 A	L/R = 40 ms
250 V	10.0 A	L/R = 20 ms

**Note:** Do not use high current interrupting output contacts to switch ac control signals. These outputs are polarity-dependent.

**Note:** Make per IEEE C37.90-1989.

### Optoisolated Inputs

The input type is dependent on the rear-panel terminal type. “Level-sensitive” inputs differ from “standard” jumper-selectable inputs in that they are guaranteed to deassert below a certain voltage level and they are not user-settable. The inputs are not polarity-dependent. With nominal control voltage applied, each input draws approximately 4 mA of current.

#### Conventional Terminal Blocks Option

The conventional terminal block model is can be ordered with either jumper-selectable voltage optoisolated inputs or level-sensitive optoisolated inputs.

#### Jumper-Selectable Control Voltage:

Both inputs may be individually user-configured to operate on any of the following nominal voltages:

24 Vdc:	on for 15–30 Vdc
48 Vdc:	on for 30–60 Vdc

125 Vdc:	on for 80–150 Vdc
250 Vdc:	on for 150–300 Vdc

**Level-Sensitive**

Both inputs are factory-configured for a fixed voltage level that cannot be changed:

48 Vdc:	on for 38.4–60 Vdc; off below 28.8 Vdc
110 Vdc:	on for 88–132 Vdc; off below 66 Vdc
125 Vdc:	on for 105–150 Vdc; off below 75 Vdc
220 Vdc:	on for 176–264 Vdc; off below 132 Vdc
250 Vdc:	on for 200–300 Vdc; off below 150 Vdc

**Plug-In Connectors Option**

Standard (Non-Level-Sensitive):

24 Vdc:	on for 15–30 Vdc
---------	------------------

Level-Sensitive:

The plug-in connectors model is equipped with fixed “level-sensitive” inputs. Both inputs are factory configured to the control voltage specified at time of ordering:

48 Vdc:	on for 38.4–60 Vdc; off below 28.8 Vdc
110 Vdc:	on for 88–132 Vdc; off below 66 Vdc
125 Vdc:	on for 105–150 Vdc; off below 75 Vdc
250 Vdc:	on for 200–300 Vdc; off below 150 Vdc

**Serial Communications**

Front and Rear Panel:	9-pin sub-D connector
Baud Rate:	300–38400 baud; settable baud rate and data bit protocol

**Time-Code Input**

Relay accepts demodulated IRIG-B time-code input at Port 1.

**Protocols**

Serial Port Protocols:	ASCII Distributed Port Switch Protocol (LMD) Modbus RTU (baud rate limited to 19200)
------------------------	--

**Metering Functions**

Instantaneous and Demand Ammetering Functions

Measurement Accuracy:	5 A Model: $\pm 2\% \pm 0.10$ A 1 A Model: $\pm 2\% \pm 0.02$ A
-----------------------	--

**Breaker Monitor**

Relay counts trip operations and accumulates interrupted current on a pole-by-pole basis.

**Routine Dielectric Strength**

Current Inputs:	2500 Vac for 10 s
-----------------	-------------------

Power Supply, Optoisolated Inputs, and Output Contacts:	3000 Vdc for 10 s
---	-------------------

The following IEC 60255-5:1977 dielectric test is performed on all units with the CE mark:

2500 Vac for 10 seconds on analog inputs.  
3100 Vdc for 10 seconds on power supply, optoisolated inputs, and contact outputs.

**Operating Temperature**

–40° to +85°C (–40° to +185°F)

**Dimensions**

8.81 cm x 21.59 cm x 23.37 cm (3.47" x 8.5" x 9.2") (H x W x D)

**Weight**

2.6 kg (5 lb, 12 oz)

**Type Tests****Electromagnetic Compatibility Emission (EMC)**

Canada ICES-001 (A) / NMB-001 (A)

**Environmental Tests**

Cold:	IEC 60068-2-1:1990 [EN 60068-1-1:1993] Test Ad; 16 hr at –40°C
Damp Heat, Steady State:	IEC 60068-2-3:1969 Test Ca; 96 hours at +40°C, 93% RH
Damp Heat, Cyclic	IEC 60068-2-30:1980 Test Db; 25° to 55°C, 6 cycles, 95% humidity
Dry Heat:	IEC 60068-2-2:1974 [EN 60068-2-2:1993] Test Bd; 16 hr at +85°C

**Dielectric Strength and Impulse Tests**

Dielectric:	IEC 60255-5:1977 IEEE C37.90:1989 2500 Vac on analogs, contact inputs, and contact outputs; 100 Vdc on power supply; 2200 Vdc on EIA-485 communications port
Impulse:	IEC 60255-5:1977 0.5 J, 5000 V

**Electrostatic Discharge Test**

ESD:	IEC 60255-22-2:1996 IEC 60801-2:1991 Level 4
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**RFI and Interference Tests**

Fast Transient Burst:	IEC 60801-4:1988 Level 4 (4 kV on power supply, 2 kV on inputs and outputs)
Fast Transient Disturbance:	IEC 60255-22-4:1992 IEC 60801-2:1991 Level 4
Radiated EMI:	IEC 60255-22-3:1989, 10 V/m
Surge Withstand:	IEEE C37.90.1-1989 3.0 kV oscillatory; 5.0 kV fast transient

**Vibration and Shock Tests**

Shock and Bump:	IEC 60255-21-2:1988 Class 2 IEC 60255-21-3:1993 Class 2
Sinusoidal Vibration:	IEC 60255-21-1:1988 Class 2

**Object Penetration**

Object Penetration:	IEC 60529:1989 IP3X
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# Technical Support

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# Notes

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