SEL-321 Data Sheet

Phase and Ground Distance Relay, Direction Overcurrent Relay, Fault Locator

Major Features and Benefits

➤ Four Zones of Phase and Ground Distance Protection:
  - ➢ Mho characteristic phase element
  - ➢ Mho and quadrilateral characteristic ground elements

➤ Supports all standard tripping schemes

➤ Phase, negative-sequence, and residual overcurrent protection

➤ Two independent negative-sequence directional elements

➤ Apply to single- and three-pole trip installations

➤ Out-of-step tripping and blocking

➤ Unique load encroachment logic

➤ Oscillography data and an 11-cycle event report

➤ As many as 16 contact outputs and 8 contact inputs in the One I/O Board version

➤ As many as 32 contact outputs and 16 contact inputs in the Two I/O Board version

➤ SELOGIC® control equations

➤ Three serial communications ports

➤ Front-panel setting and display

➤ Automatic self-testing; Fault locating; Metering

General Description

The SEL-321 Relay protects, controls, and monitors EHV, HV, and subtransmission lines. The relay contains all protective elements and control logic to protect any overhead transmission line.

The relay is a complete protective relay package for pilot and non-pilot schemes. The following list highlights a few of the protective features of the SEL-321 relay.

➤ Four zones of phase and ground distance protection
➤ Independent internal, user-settable timers delay Zone 2, 3, or 4 phase and ground elements for time-stepped coordination with downstream relays
➤ Any zone may be set forward or reversed
➤ Independently set phase and ground distance elements
➤ Ground distance can be selected for mho characteristic, quadrilateral characteristic, or both
➤ Quadrilateral characteristic on ground distance element adds sensitivity for high-resistance faults, compensates for load flow, and prevents over- and underreaching
➤ Positive-sequence memory polarization provides expanded resistive coverage for phase and ground faults
➤ Independent phase, negative-sequence, and residual time-overcurrent elements
➤ Four levels of instantaneous/definite time negative-sequence and residual overcurrent elements
➤ Typical operating time of one cycle for three-phase faults

➤ Oscillography and event-reporting data
➤ Front-panel setting and display

SEL-321 Relay Benefits

The relay offers a large number of protective elements and features. You tailor the relay to your particular application by using SELOGIC control equations to select specific functions.

If your protection requirements change, the relay is readily adapted by entering new settings. The logic required for the new scheme is enabled, and those settings are entered. This allows change or expansion at no cost because additional protective relays or logic cards are not required.

The relay has six independent setting groups. With this increased flexibility, the relay may be configured for virtually any operating condition: substitute line relay, line configuration changes, source changes, etc.

Benefits gained using the SEL-321 relay include:
➤ Application flexibility
➤ Simplified settings: set only the elements you are using
➤ Relay is readily expanded to more complex schemes at no cost
➤ SELOGIC control equations allow you to program the relay to meet any application needs
➤ Fault locator reduces patrol and outage time
➤ Communications handle remote interrogation
➤ Self-testing increases relay availability

Applications

Versatility

The SEL-321 relay handles all overhead line protective relaying applications because it is both versatile and economical. The programming versatility of the relay allows use in pilot and non-pilot schemes.

The relay fits a large number of applications. Basic schemes can be implemented by only selecting the elements used for that relay application. For more complex schemes, select more protective elements.

Communication Schemes

The SEL-321 is the ideal relay for use in communications-based schemes. Dedicated SELOGIC control equations allow selection of relay elements to perform

specific functions when external conditions are met. In addition to the communications scheme logic, the SEL-321 provides time-stepped backup protection without the need for external wiring modifications or dedicated input contacts.

The SEL-321 overcomes typical deficiencies associated with communications-based schemes. Most communications-based schemes are vulnerable to conditions that may result in an incorrect trip if logic is not provided to account for them.

For example:
➤ Current reversals
➤ Weak-infeed conditions at one terminal
➤ Breaker open at one terminal
➤ Switch-onto-fault conditions

While communications equipment circuitry can account for these shortcomings, it may not be available for applications where only the protective relaying is being upgraded, or when dependence on this external circuitry is neither economical nor desirable.

The SEL-321 logic accounts for the deficiencies listed above. If the communication channel is lost or out of service, time-step backup protection is provided without special switching of detection schemes. The SEL-321 is capable of supporting permissive overreaching transfer trip scheme, direct and permissive underreaching transfer trip schemes, direct transfer trip schemes, and directional comparison blocking and unblocking schemes.

Obsolete Relay Replacement

The SEL-321 is an ideal replacement for aging or obsolete electromechanical relays. If protective relays are to be upgraded at one terminal only, it is important that relays have measuring principles compatible with surrounding terminals.

Compact size and simple field wiring make replacement of electromechanical relays with an SEL-321 especially convenient in crowded substations. Both horizontal and vertical mounting configurations are available. The required panel cutout dimensions are equivalent to that of a single electromechanical distance relay, which eliminates panel cutting where relays already exist. Event-reporting and fault-locating features economically provide valuable engineering and operating information, eliminating the need for event recorders and oscillographs in most applications. A negligible instrument transformer burden makes the SEL-321 an attractive alternative for overburdened current and potential transformers.

Applications include:
- ➤ Single- or multiple-zone relaying schemes
- ➤ Time-stepped distance schemes
- ➤ Communications assisted schemes
- ➤ Single- and three-pole tripping
- ➤ Overcurrent protection with phase or ground distance supervision
- ➤ Replacement of electromechanical relays
- ➤ Substitute line relay

Operating Principles

Mho Distance

The SEL-321 uses mho characteristics for phase and ground distance protection. *Figure 1* illustrates the impedance characteristics of the phase and ground distance elements.
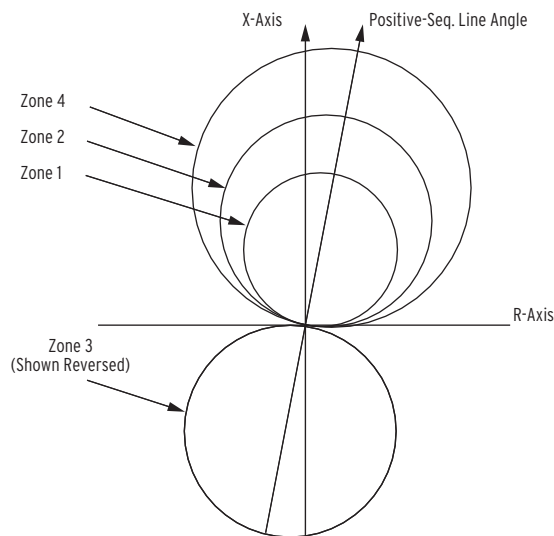
All mho elements use positive-sequence polarization that expand in proportion to the source impedance, and provide positive, secure operation for close-in faults.

Figure 2 shows the forward-reaching mho characteristic for a forward phase-to-phase fault. The mho circle expands to the source impedance ZS, but never more than the set relay reach, ZR.

Positive-sequence memory polarization provides added security during the open-pole period when used in single-pole trip applications.
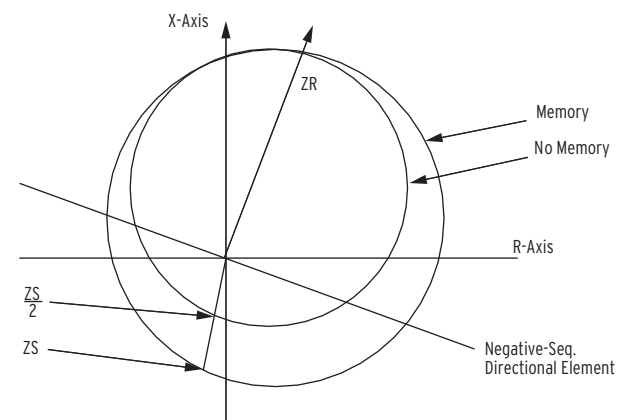

Figure 1   Phase and Ground Mho Distance Characteristics

Figure 2   Phase-to-Phase Element Response for a Forward Phase-to-Phase Fault

Quadrilateral Distance

The relay also provides ground quadrilateral characteristics. The top line of the quadrilateral characteristic compensates for load flow to avoid under- and overreaching. The ground mho and quadrilateral distance elements may be used individually or concurrently.
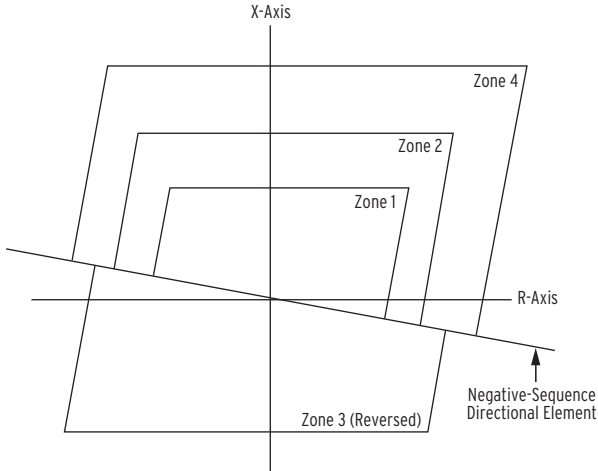

Figure 3   Quadrilateral Ground Distance Characteristics

Overcurrent Elements

Phase, negative-sequence, and residual overcurrent elements provide primary or backup protection. Phase and ground distance elements can supervise the overcurrent elements for greater selectivity.

Negative-Sequence Directional Element

The relay uses a unique negative-sequence directional element, which calculates the negative-sequence impedance at the relaying point. Thresholds are set that declare the fault in the forward or reverse direction. *Figure 4* illustrates the negative-sequence directional measurement technique.
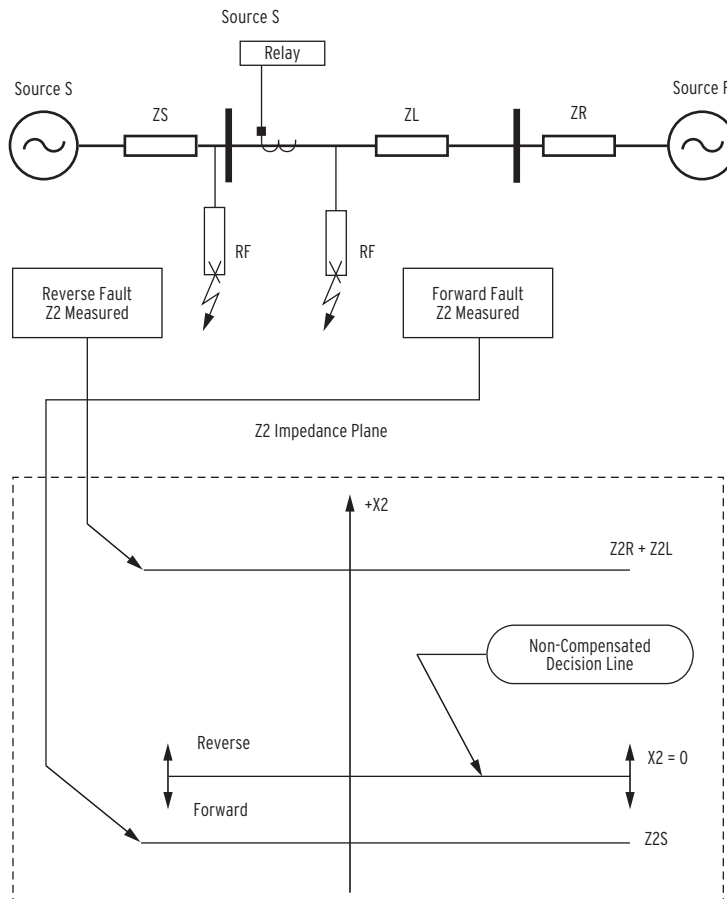

Figure 4   Negative-Sequence Directional Element Measurement

Load Encroachment

A load encroachment feature prevents operation of the phase elements under high load conditions. This unique feature permits load to enter a predefined area of the phase distance characteristic without causing a tripout. *Figure 5* shows the load encroachment characteristic.
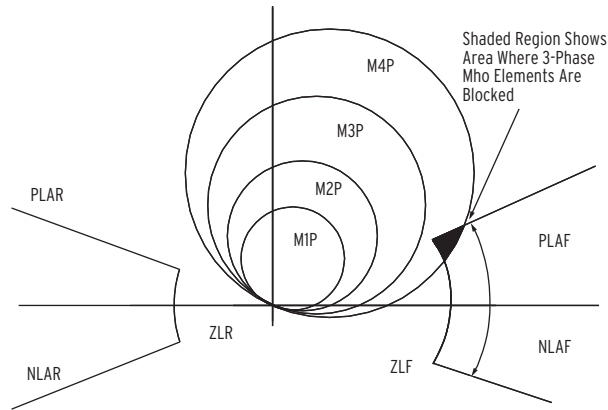

Figure 5   Load Encroachment Characteristic

Scheme Selection

With a simple setting, any of the four zones of phase and ground distance protection may be set in the forward or reverse direction. The number of phase or ground distance zones is selectable.

Select mho and/or quadrilateral characteristic for ground distance. Mho elements give speed; quadrilateral elements give sensitivity. Each of the eight ground elements has its own reach setting.

Ground Distance Elements

The ground distance elements include two zero-sequence compensation factors (k01, k0). This allows compensation for remote faults when there are intermediate sources of zero-sequence current; such as lines with tapped transformer banks with a grounded-wye configuration.

Time-Overcurrent Elements

There are three independent time-overcurrent elements: phase for backup phase fault protection, negative-sequence for sensitive phase-to-phase fault detection or ground fault detection, and residual for ground fault detection.

Torque Control

The phase overcurrent element may be torque-controlled by the Zone 2 phase distance elements. The negative-sequence and residual overcurrent elements may be torque-controlled by the Zone 2 ground distance or negative-sequence directional elements.

Negative-Sequence/Residual Overcurrent

There are four levels of instantaneous/definite time negative-sequence and residual overcurrent protection. Each level provides backup protection. The instantaneous output of each level finds use in the communications scheme and control logic.

Communications-Based Schemes

The relay supports the following communications-based protection schemes:

➤ Permissive Overreaching Transfer Trip (POTT)
➤ Permissive Underreaching Transfer Trip (PUTT)
➤ Directional Comparison Unblocking (DCUB)
➤ Directional Comparison Blocking (DCB)
➤ Direct Underreaching Transfer Trip (DUTT)
➤ Direct Transfer Trip (DTT)

Current reversal logic provides for POTT, DCUM, and DCB scheme applications. To preserve the security of the parallel healthy line, the relay uses reverse Zone 3 elements, timers, and associated logic to block permissive tripping in POTT and DCUB schemes. In DCB schemes, the block trip signal transmission time is extended to allow time for the remote Zone 2 elements to drop out.
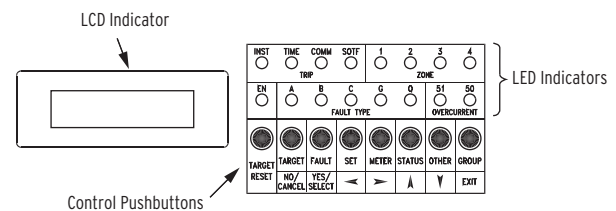
Additional Features

Front-Panel Display

The LCD display, *Figure 6*, gives detailed information pertaining to a fault detected by the relay, by displaying meter information, relay self-test status information, and settings parameters.

Sixteen LEDs on the front panel give targeting information, fault type, and type of tripping.

Figure 6   SEL-321 Front-Panel Layout

Serial Communications Ports

The relay has three serial communications ports for local or remote access to relay settings, meter, and fault data. Two serial ports are on the rear panel, and a local interface port is provided on the relay front panel. Remote communications allow operators to retrieve relay fault and meter information from a central control station.

A multi-level password security scheme impedes unauthorized access to the relay. A lower level password allows examination of relay settings, meter data, and event records. Setting changes are available only from the upper password level. Line breaker control functions are also protected with a third level of password protection.

The relay does not require special communications software. Dumb terminals, printing terminals, or a computer supplied with terminal emulation and a serial communications port is all that is required.

Event Reporting and Oscillography

The relay generates an 11-cycle event report following each system disturbance detected by the relay or upon command. The report provides four cycles of pre-fault data and seven cycles of post-fault data. The data in each report includes voltages, currents, relay element status, and relay inputs and outputs. The report also includes the calculated fault location, date, and time of the event.

This information simplifies post-fault analysis and improves understanding of simple and complex protective scheme operation. This relay stores the last 12 event reports for local or remote retrieval.

Two formats of event reports are available. The default event report allows you to quickly review a routine relay operation. This event report displays the important voltage, current, protective element status, I/O contact status in quarter-cycle increments for the full 11 cycles. The ASCII Hex data are also used for oscillography with the SEL-5601-2 SYNCHROWAVE® Event Software program.

SELOGIC Control Equations

SELOGIC control equations put relay logic in the hands of the relay application engineer. Assign the relay inputs to suit your application, logically combine selected relay elements for various control functions, and assign output relays to your logic functions.

Programming SELOGIC control equations consist of ANDing, ORing, or inverting the individual Relay Word elements. Any element in the Relay Word can be used in the SELOGIC control equations.

Configure the contact outputs to operate when any of the protective elements and logic outputs assert. Implement complete protective schemes by using a minimum of wiring and panel space. Programmable contact closure simplifies testing by indicating pickup and dropout of only those elements under test.

Contact Inputs and Outputs

The SEL-321 relay series provides 8 contact inputs and 16 contact outputs in the one I/O board version. A two I/O board version is available with 16 contact inputs and 32 contact outputs. The contact inputs are assigned for control functions, monitoring logic, and general indication. Except for a dedicated alarm output, each contact output is independently programmable by using SELOGIC control equations. All relay output contacts are rated for trip duty.
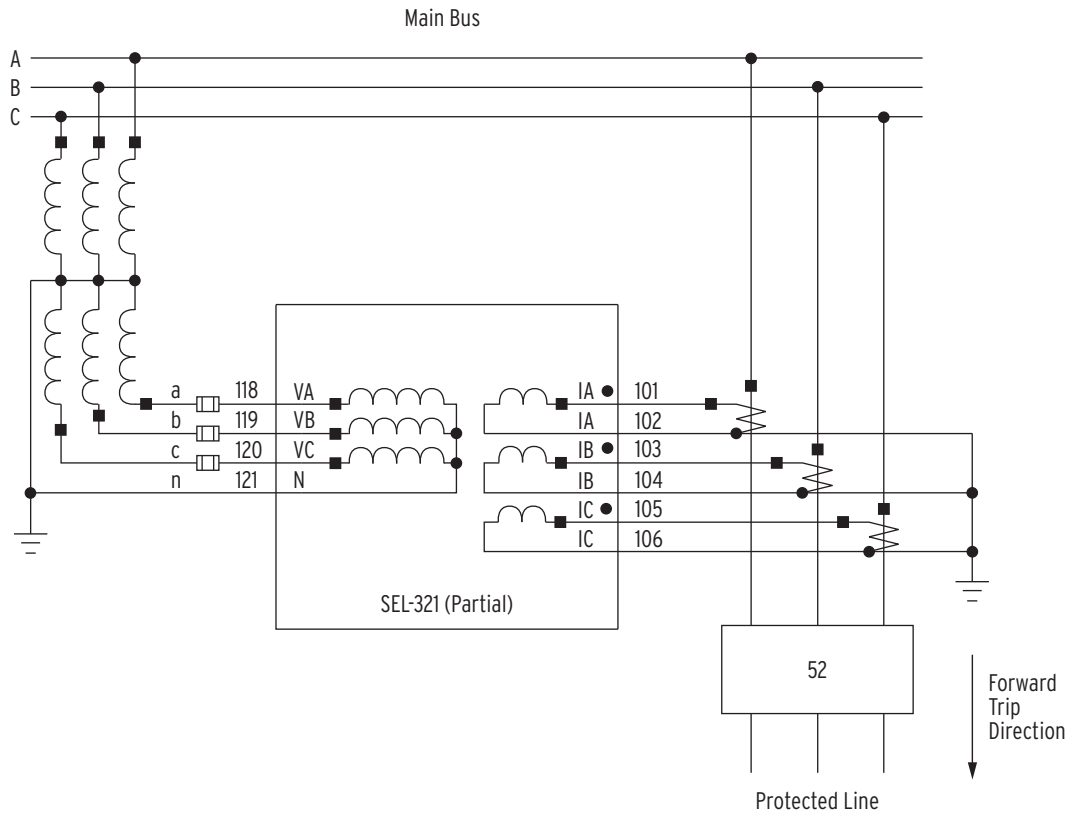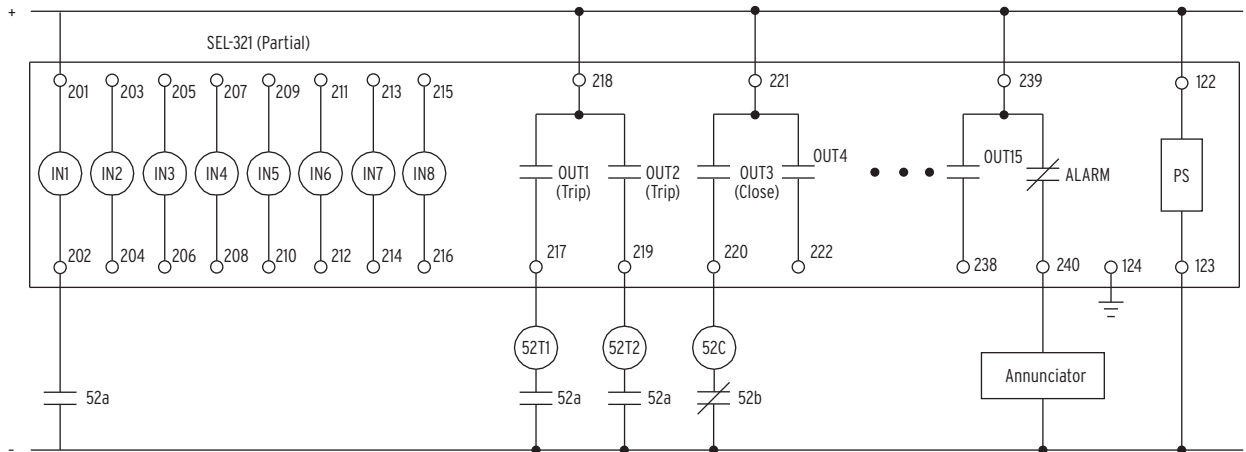
Wiring Diagrams

Figure 7   SEL-321 Relay External AC Current and Voltage Connections

NOTE: All inputs and outputs are assignable.

Figure 8   SEL-321 Relay External DC Connection Diagram (Typical—One I/O Board Version Shown)
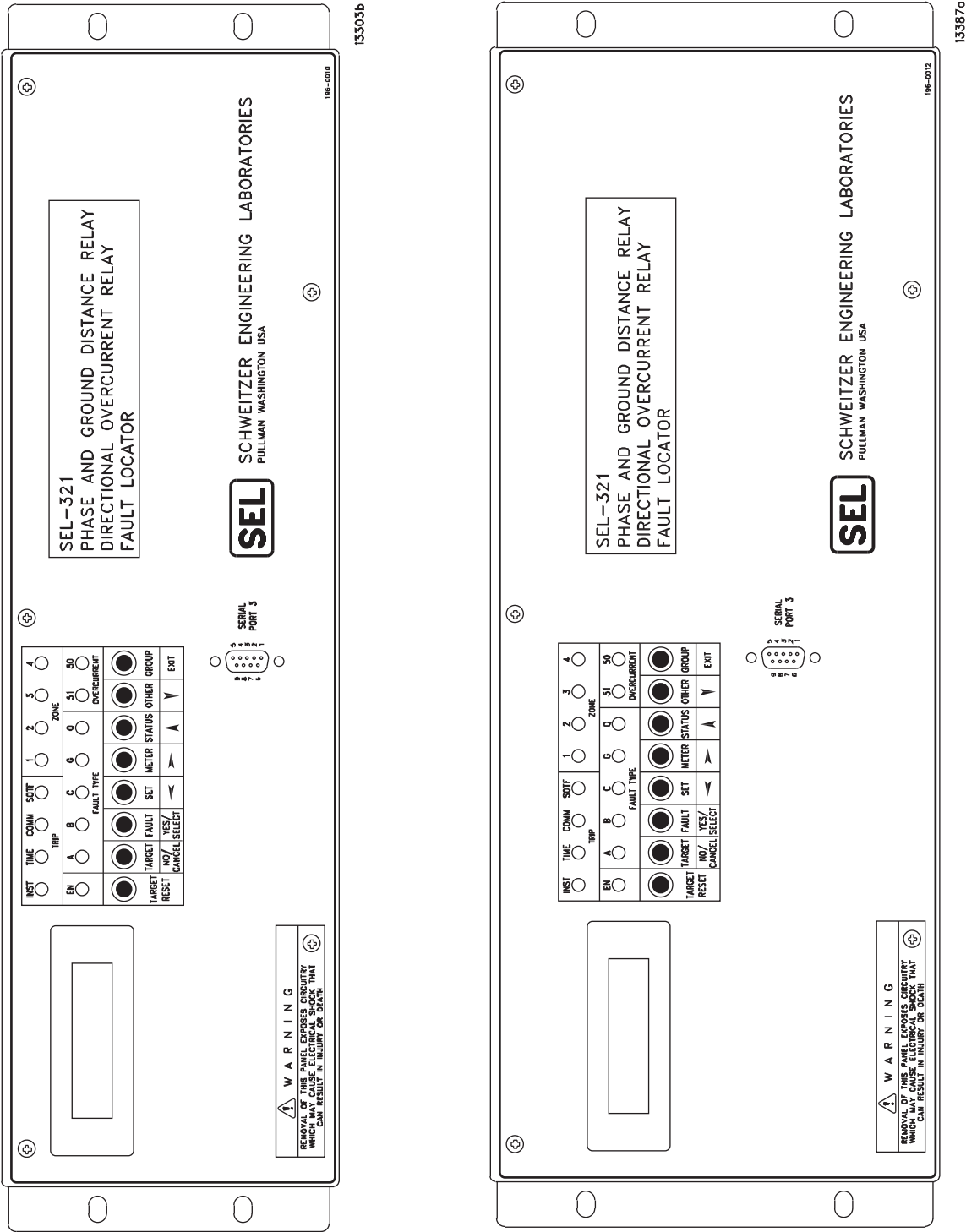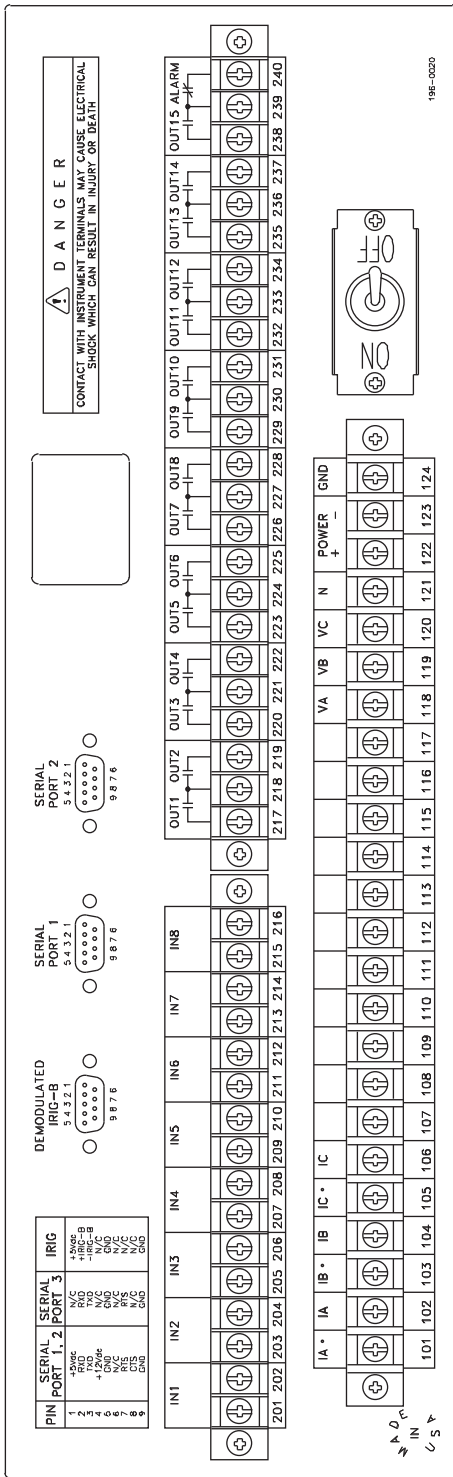
Front- and Rear-Panel Diagrams

Figure 9   SEL-321 Front-Panel Diagrams

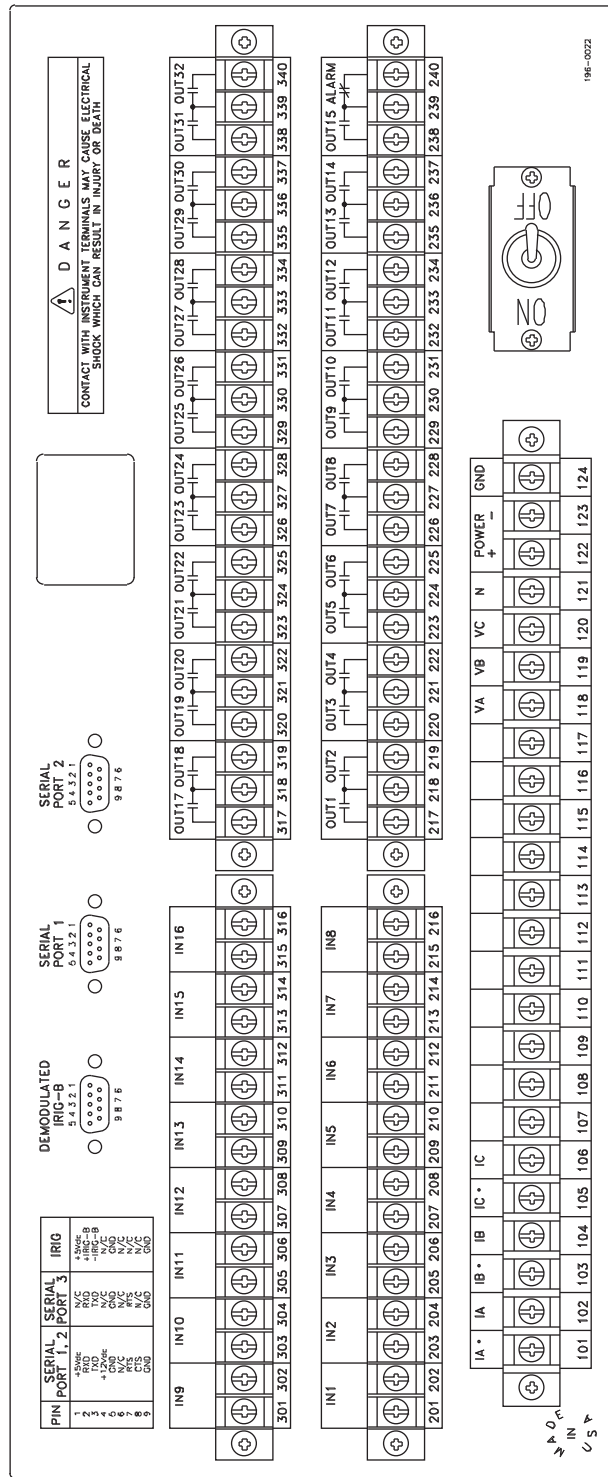**Figure 10   SEL-321 Rear-Panel Diagrams**

Relay Dimensions
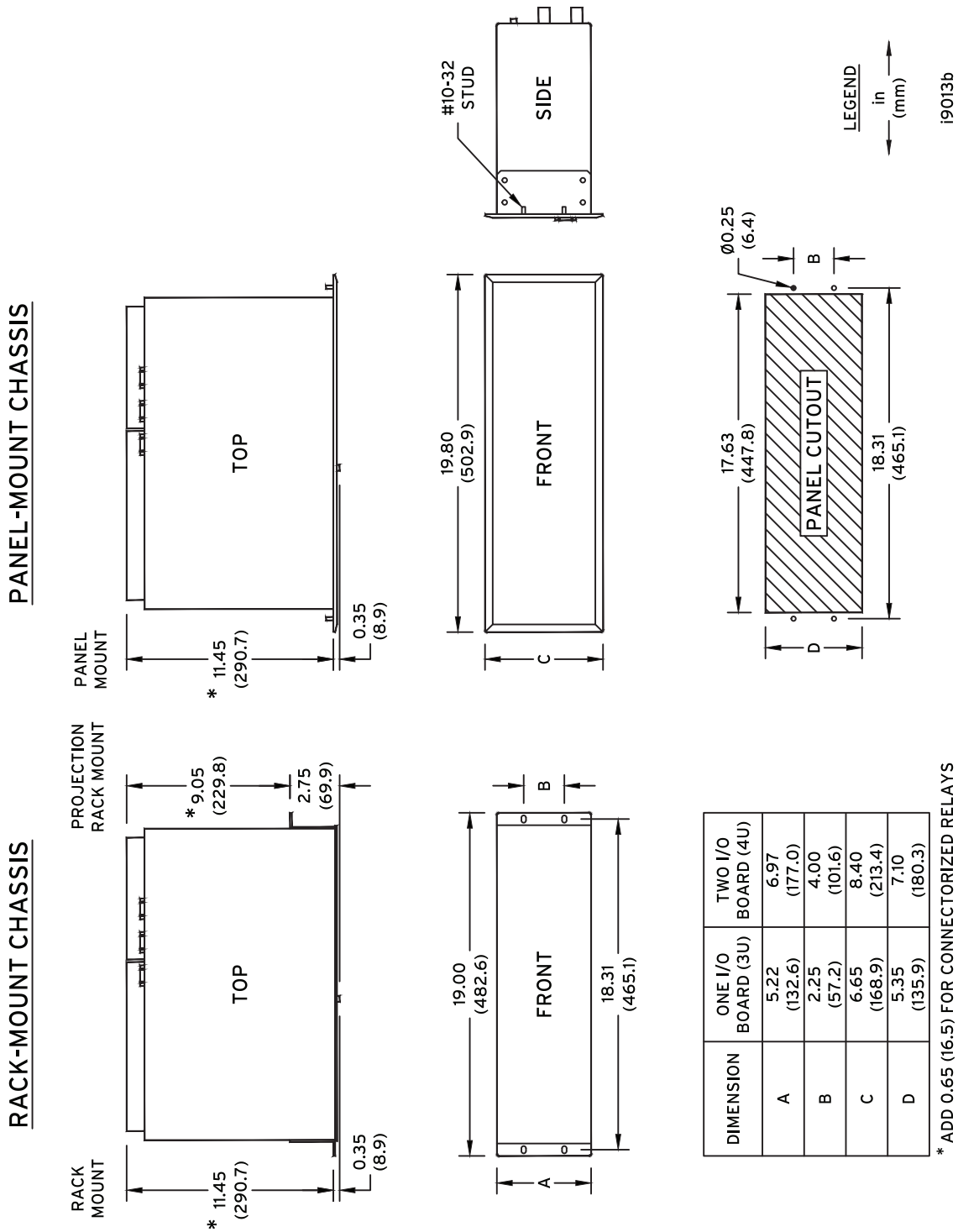
Figure 11   SEL-321 Dimensions for Rack- and Panel-Mount Models

DIMENSION	ONE I/O BOARD (3U)	TWO I/O BOARD (4U)
A	5.22 (132.6)	6.97 (177.0)
B	2.25 (57.2)	4.00 (101.6)
C	6.65 (168.9)	8.40 (213.4)
D	5.35 (135.9)	7.10 (180.3)

* ADD 0.65 (16.5) FOR CONNECTORIZED RELAYS

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

General

AC Voltage Inputs

67 V_{L-N}, three-phase four-wire connection
150 V_{L-N} continuous (connect any voltage as high as 150 Vac)
365 Vac for 10 seconds

Burden:	0.13 VA at 67 V
	0.45 VA at 120 V

AC Current Inputs

5 A nominal:	15 A continuous, linear to 100 A symmetrical, 500 A for 1 s 1250 A for 1 cycle
Burden:	0.27 VA @ 5 A
	2.51 VA @ 15 A
1 A nominal:	3 A continuous, linear to 20 A symmetrical, 100 A for 1 s 250 A for 1 cycle
Burden:	0.13 VA @ 1 A
	1.31 VA @ 3 A

Terminal Connections

Rear Screw-Terminal Tightening Torque:	Minimum: 8 in-lb (0.9 Nm) Maximum: 12 in-lb (1.4 Nm)

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

Output Contacts

Standard

Make:	30 A
Carry:	6 A continuous carry
1 s Rating:	100 A
MOV Protection:	270 Vac, 360 Vdc; 40 J
Pickup Time:	<5 ms
Dropout Time:	<8 ms

Breaking Capacity (10000 operations):

48 V	0.5 A	L/R = 40 ms
125 V	0.3 A	L/R = 40 ms
250 V	0.2 A	L/R = 40 ms

Cyclic Capacity (2.5 cycle/second):

48 V	0.5 A	L/R = 40 ms
125 V	0.3 A	L/R = 40 ms
250 V	0.2 A	L/R = 40 ms

High-Current Interrupting Option

Make:	30 A
Carry:	6 A continuous carry at 70°C
MOV Protection:	330 Vdc
Pickup Time:	<5 ms
Dropout Time:	<8 ms

Breaking Capacity (10000 operations):

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/second followed by 2 minutes idle for thermal dissipation):

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.

Fast High-Current Interrupting Option

Make:	30 A
Carry:	6 A continuous carry
MOV Protection:	330 Vdc
Pickup Time:	<200 µs
Dropout Time:	<8 ms (typical)

Breaking Capacity (10000 operations):

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/second followed by 2 minutes idle for thermal dissipation):

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: Fast high-current interrupting outputs are not polarity-dependent. See *Appendix I: Interface Board Specifications* for further details.
Note: Make per IEEE C37.90:1989; breaking and cyclic capacity per IEC 60255-23:1994.

Optoisolated Inputs

Standard Fixed Inputs

250 Vdc:	Pickup 200–300 Vdc; dropout 150 Vdc
125 Vdc:	Pickup 105–150 Vdc; dropout 75 Vdc
48 Vdc:	Pickup 38.4–60 Vdc; dropout 28.8 Vdc
24 Vdc:	Pickup 15.0–30 Vdc

Fixed Level-Sensitive Inputs

250 Vdc:	On for 200–300 Vdc; off below 150 Vdc
125 Vdc:	On for 105–150 Vdc; off below 75 Vdc
48 Vdc:	On for 38.4–60 Vdc; off below 28.8 Vdc

Note: Nominal input current is 4 mA.

Time-Code Input

Relay accepts demodulated IRIG-B time-code input.

Communications Ports

EIA-232:	1 front and 2 rear

Power Supply

125/250 Vdc or Vac

Range:	85–350 Vdc or 85–264 Vac
Burden:	<25 W

48/125 Vdc or 125 Vac

Range:	38–200 Vdc or 85–140 Vac
Burden:	<25 W

24/48 Vdc

Range:	18–60 Vdc polarity-dependent
Burden:	<25 W

Dimensions

One I/O Board:	5.22" H x 19" W x 11.66" D (133 mm x 483 mm x 296 mm)
Two I/O Boards:	6.97" H x 19" W x 11.66" D (177 mm x 483 mm x 296 mm)

Operating Temperature

–40° to +85°C (–40° to +185°F)

Environment

Cold:	IEC 60068-2-1:2007 –40°C, 16 hours
Dry Heat:	IEC 60068-2-2:2007 +85°C, 16 hours
Damp Heat, Cyclic:	IEC 60068-2-30:2005 25°C to 55°C, 6 cycles relative humidity: 95%

EMC Immunity

Emissions:	Canada ICES-001 (A) / NMB-001 (A)
Surge Withstand:	IEEE C37.90.1:2002 2.5 kV oscillatory 4.0 kV fast transient IEC 60255-22-1: 2007 2.5 kV common mode 1.0 kV differential mode
Electrical Fast Transient/Burst:	IEC 60255-22-4:2008 4 kV, 5 kHz 2 kV, 5 kHz on communications ports
Radiated RF Immunity	IEC 60255-22-3:2007 IEC 61000-4-3:2010 10 V/m ENV 50204:1995 10 V/m at 900 MHz and 1.89 GHz IEEE C37.90.2:2004 35 V/m
Electrostatic Discharge Test	
ESD:	IEC 60255-22-2:2008 IEC 61000-4-2:2008 2, 4, 6, 8 kV contact; 2, 4, 8, 15 kV air IEEE C37.90.3:2001 2, 4, 8 kV contact; 4, 8, 15 kV air
Power Frequency Magnetic Field:	IEC 61000-4-8:2009 1000 A/m, 3 seconds 100 A/m, 60 seconds
Power Supply Immunity:	IEC 60255-11:2008 IEC 61000-4-11:2004 IEC 61000-4-29:2000
Conducted RF Immunity:	IEC 61000-4-6:2008 10 Vrms

Insulation Coordination

Dielectric Strength (Hipot)/Impulse:	IEC 60255-5:2000 IEEE C37.90:2005 Dielectric Strength; 2500 Vac on contact inputs, contact outputs, and analog inputs. 3100 Vdc on power supply. Impulse: 5 kV, 0.5 J

Vibration and Shock Tests

	IEC 60255-21-1:1988 Class 1 Endurance, Class 2 Response IEC 60255-21-2:1988 Class 1 Shock Withstand, Bump Class 2 Shock Response IEC 60255-21-3:1992 Class 2 Quake Response

RF Emissions

Radiated and Conducted Emissions:	IEC 60255-25:2000 FCC CFR 47 Part 15, Class A

Ingress Protection

Object/Water Penetration:	IEC 60259:2001 + CRGD:2003 IPX4 on front panel

Weight

One I/O board:	20 lb (9.1 kg); shipping weight 32 lb (14.5 kg)
Two I/O boards:	26.5 lb (12 kg); shipping weight 40.6 lb (18.5 kg)

Relay Elements

Phase Mho Distance

Secondary Reach Setting Range:	0.25–320 Ω at the line angle (1 A Nominal) 0.05–64 Ω at the line angle (5 A Nominal)

Ground Mho Distance

Secondary Reach Setting Range:	0.25–320 Ω at the line angle (1 A Nominal) 0.05–64 Ω at the line angle (5 A Nominal)
$\lvert k_{01} \rvert$ and $\lvert k_0 \rvert$ Setting Range*:	0–4
Angle k_{01} and k_0 Setting Range*:	±180° in 0.1° steps

* **Note:** Same setting applies to Quadrilateral Ground Distance.

Quadrilateral Distance

Secondary Reactive Reach:	0.25–320 Ω (1 A Nominal) 0.05–64 Ω (5 A Nominal)
Secondary Resistance Reach:	0.25–250 Ω (1 A Nominal) 0.05–50 Ω (5 A Nominal)
Nonhomogeneous Factor (T, degrees):	±20° in 0.1° steps

Out-of-Step Distance

Secondary Reactance Setting Range:	±480 Ω (1 A Nominal) ±96 Ω (5 A Nominal)
Secondary Resistance Setting Range:	±350 Ω (1 A Nominal) ±70 Ω (5 A Nominal)

Load Encroachment Detection

Secondary Impedance Setting Range:	0.25–320 Ω (1 A Nominal) 0.05–64 Ω (5 A Nominal)
Forward Load Angle Setting (in Degrees):	–90° to +90°
Reverse Load Angle Setting (in Degrees):	+90° to 270°

Distance Element Accuracy

Secondary Steady-State Error:	1 A Nominal ±5% of set reach ±0.05 Ω at line angle (LA) for V > 5 V and I > 0.4 A ±10% of set reach ±0.05 Ω at LA for 1 V < V < 5 V and 0.2 A < I < 0.4 A 5 A Nominal ±5% of set reach ±0.01 Ω at line angle (LA) for V > 5 V and I > 2 A ±10% of set reach ±0.01 Ω at LA for 1 V < V < 5 V and 1 A < I < 2 A
Transient Overreach Error:	±5% of set reach, plus steady-state error

Negative-Sequence Directional Element

Secondary Positive-Sequence Current Restraint Range:	0.02–0.5
Secondary Forward Directional Current Supervision:	0.05–1 A (1 A Nominal) 0.25–5 A (5 A Nominal)
Secondary Reverse Directional Current Supervision:	0.05–1 A (1 A Nominal) 0.25–5 A (5 A Nominal)
Secondary Forward Directional Impedance Setting:	±320 Ω (1 A Nominal) ±64 Ω (5 A Nominal)
Secondary Reverse Directional Impedance Setting:	±320 Ω (1 A Nominal) ±64 Ω (5 A Nominal)

Supervisory Overcurrent

Phase

Secondary Pickup Setting Range:	0.1–20 A, ±0.01 A, ±3% of setting (1 A Nominal) 0.5–100 A, ±0.05 A, ±3% of setting (5 A Nominal)

Supervises Ground Distance

Phase-to-Phase

Secondary Pickup Setting Range:	0.2–34 A, ±0.01 A, ±3% of setting (1 A Nominal) 1.0–170 A, ±0.05 A, ±3% of setting (5 A Nominal)

Supervises Phase Distance

Positive-Sequence

Secondary Pickup Setting Range:	0.2–20 A, ±0.01 A, ±3% of setting (1 A Nominal) 1.0–100 A, ±0.05 A, ±3% of setting (5 A Nominal)

Supervises OOS Logic

Residual

Secondary Pickup Setting Range:	0.1–20 A, ±0.01 A, ±3% of setting (1 A Nominal) 0.5–100 A, ±0.05 A, ±3% of setting (5 A Nominal)
Transient Overreach:	±5% of pickup

Supervises ground distance

Directional Time-Overcurrent

Selectable Curve Shape:	Moderately inverse (US) or Longtime Standby (IEC) Inverse (US) or Standard Inverse (IEC) Very Inverse (US or IEC) Extremely Inverse (US or IEC)
Phase Pickup Setting Range:	0.1–3.4 A, ±0.05 A, ±3% of setting (1 A Nominal) 0.5–16 A, ±0.05 A, ±3% of setting (5 A Nominal)
Neg.-Seq. Pickup Setting Range:	0.1–3.2 A, ±0.05 A, ±3% of setting (1 A Nominal) 0.5–16 A, ±0.05 A, ±3% of setting (5 A Nominal)
Residual Pickup Setting Range:	0.1–3.2 A, ±0.05 A, ±3% of setting (1 A Nominal) 0.5–16 A, ±0.05 A, ±3% of setting (5 A Nominal)

Time Dial Setting Range:	0.5–15 in 0.01 steps (US) 0.05–1 in 0.01 steps (IEC)
Timing:	±4% and ±1.5 cycles for current magnitude between 2 and 20 multiples of pickup

Nondirectional Residual/Neg.-Seq. Overcurrent

Secondary Pickup Setting Range:	0.05–16 A, ±0.01 A, ±3% of setting (1 A Nominal) 0.25–80 A, ±0.05 A, ±3% of setting (5 A Nominal)
Transient Overreach:	±5% of pickup

Overvoltage

Pickup:	0–150 V, ±5% of setting, ±1 V
Transient Overreach:	±5% of pickup

Undervoltage

Pickup:	0–100 V, ±5% of setting, ±1 V
Transient Overreach:	±5% of pickup

Miscellaneous Timers

Step Distance Time Delay:	0–2000 cycles
Communications Scheme Time Delay:	0–2000 cycles
DCB Carrier Coordination Time Delay:	0–60 cycles
Short Delay Time Delay:	0–2000 cycles
Long Delay Time Delay:	0–8000 cycles
Loss-of-Potential Set Time Delay:	0–60 cycles

Notes

PDS321-01