



# SEL-2245-42 AC Protection Module

The SEL-2245-42 provides ac analog inputs for the SEL Axion<sup>®</sup>. Install as many as nine SEL-2245-42 modules within an Axion node and as many as sixteen SEL-2245-42 modules per system in any combination.

## Front Panel



Figure 1 SEL-2245-42 AC Protection Module

## Mechanical Installation

Each SEL-2242 chassis/backplane has four or ten slots, labeled A-J. Slots B-J support the SEL-2245-42 modules.

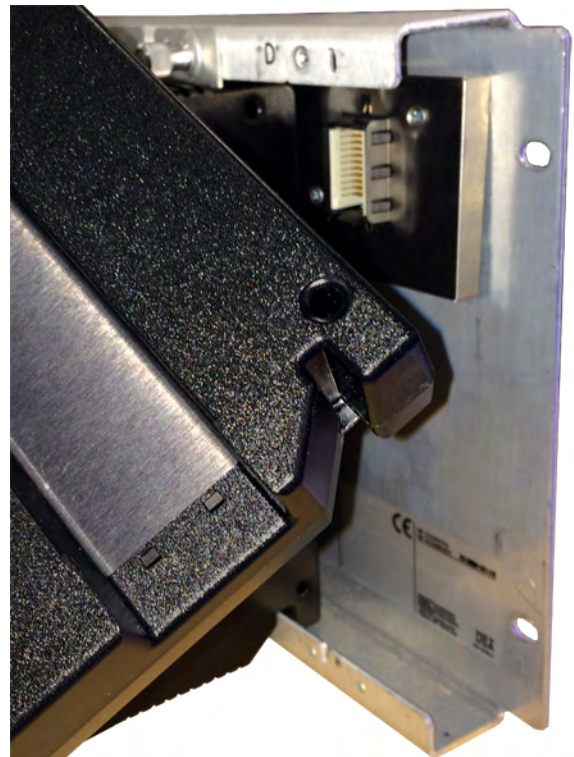
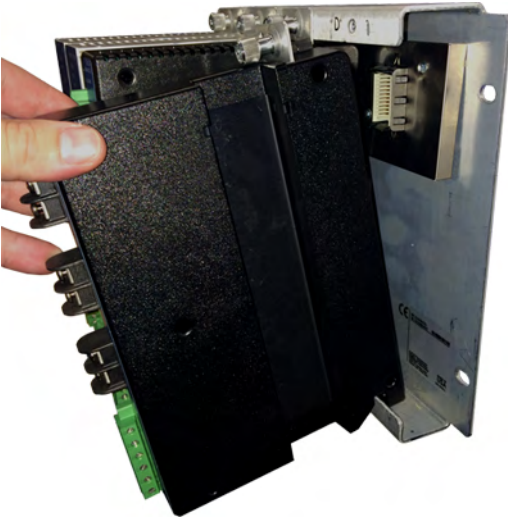


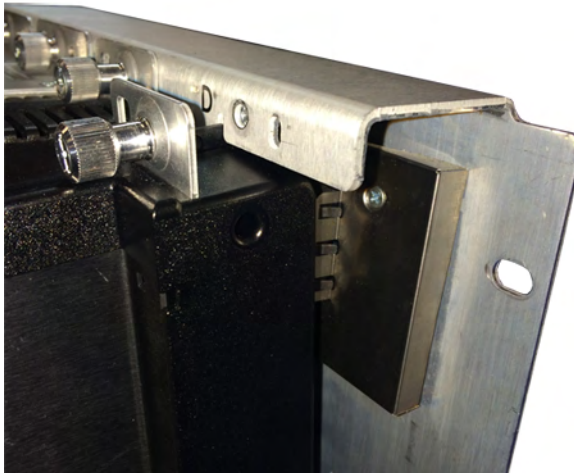
Figure 2 Notch for Module Alignment

To install an SEL-2245-42 module, tip the top of the module away from the chassis, align the notch on the bottom of the module (shown in *Figure 2*) with the slot you want on the chassis, and place the module on the bottom lip of the chassis, as *Figure 3* illustrates. The module is aligned properly when it rests entirely on the lip of the chassis.



**Figure 3 Proper Module Placement**

Next, carefully rotate the module into the chassis, making sure that the alignment tab fits into the corresponding slot at the top of the chassis (refer to *Figure 4*). Finally, press the module firmly into the chassis and tighten the chassis retaining screw.

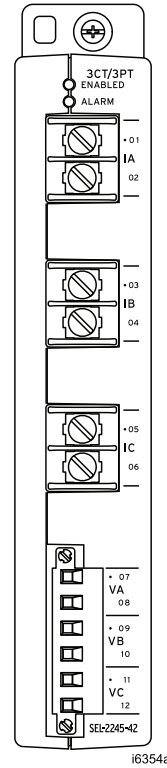


**Figure 4 Final Module Alignment**

## Input Connections

The SEL-2245-42 CT/PT analog inputs include a dot next to the terminal number to indicate the positive connection. Refer to *Specifications* for ac analog input rat-

ings and to *Figure 5* for terminal assignments. You can configure potential transformer (PT) inputs for 6–300 V and current transformer (CT) inputs for 0–20 A. Configure inputs by adding a Fieldbus I/O connection for each module in ACSELERATOR RTAC® SEL-5033 Software. See the EtherCAT® portion in *Section 2: Communications* in the SEL-5033 Software Instruction Manual for details.



**Figure 5 CT/PT Analog Inputs**

## LED Indicators

The LEDs labeled **ENABLED** and **ALARM** are related to EtherCAT network operation. The green **ENABLED** LED illuminates when the module is operating normally on the network. The **ALARM** LED illuminates during network initialization or when there is a problem with the network.

# Specifications

## Compliance

Designed and manufactured under an ISO 9001 certified quality management system

UL Listed to U.S. and Canadian safety standards (File E220228; NRAQ, NRAQ7)

CE Mark

## General

### Operating Temperature Range

-40° to +85°C (-40° to +185°F)

### Operating Environment

Pollution Degree:	2
Overvoltage Category:	III
Insulation Class:	1
Relative Humidity:	5–95%, noncondensing
Maximum Altitude:	2000 m

## AC Analog Input Channels

Frequency	
Rated:	50/60 Hz
Range:	40–90 Hz
Typical Accuracy:	±0.005 Hz above 20 V
Worst Case Accuracy:	±0.01 Hz above 20 V
Phase Rotation:	ABC, ACB
Input Configuration:	3-Wire Delta, 4-Wire Wye
Update Intervals	
Fundamental Metering:	250 Hz
RMS:	250 Hz, 1 cycle window

## AC Current Channels

Nominal Current:	1 A <sub>RMS</sub> or 5 A <sub>RMS</sub> (no setting required)
Current Range Rating (With DC offset at X/R = 10, 1.5 cycles):	0.1–91 A
Operational Range:	0.1–300 A <sub>RMS</sub>
Measurement Range:	0.1–20 A <sub>RMS</sub>
Thermal Withstand Limit:	15 A <sub>RMS</sub> continuous 500 A <sub>RMS</sub> for one second
Fundamental Measurement Accuracy	
Magnitude:	±0.1%, typical, ±0.001 A ±2%, worst case, ±0.001 A
Phase:	±0.1°, typical at f <sub>NOM</sub> and current > 0.4 A ±1°, over full rated temperature range ±2°, worst case
RMS Measurement Accuracy	
Magnitude:	±0.1%, typical, ±0.001 A ±2%, worst case, ±0.001 A
Burden:	<0.1 VA

## AC Voltage Channels

Rated Range:	67–240 V <sub>L-N</sub>
<b>Note:</b> Rated Range refers to the IEEE C37.118 rating system.	
Operational Range:	0–300 V <sub>L-N</sub>
Accuracy Range:	6.7–300 V <sub>L-N</sub>

Rated Insulation Voltage: 300 V<sub>L-N</sub> continuous  
600 V<sub>L-N</sub> for ten seconds

### Galvanic Isolated Channels

Channel-to-Ground and  
Channel-to-Channel: 2.5 kV<sub>RMS</sub> for one minute

### Fundamental Measurement Accuracy

Magnitude: ±0.1%, typical, plus ±0.05 V  
±3%, worst case, plus ±0.05 V

Phase: ±0.1° @ f<sub>NOM</sub>, typical  
±1° @ f<sub>NOM</sub>, over full rated temperature range  
±2° @ f<sub>NOM</sub>, worst case

### RMS Measurement Accuracy

Magnitude: ±0.1%, typical, plus ±0.05 V  
±3%, worst case, plus ±0.05 V

Burden: <0.01 VA @ 67 V  
Impedance > 500 kΩ

## Sequence Components

Values: I0, I1, I2, V0, V1, V2

**Note:** Sequence components are of the fundamental frequency.

### Accuracy

Magnitude: ±1%, typical

Angle: ±0.5°, typical

## Power and Power Factor (Per-Phase and Three-Phase)

Values: PA, PB, PC, PAB, PBC, PCA  
QA, QB, QC, QAB, QAC, QCA  
SA, SB, SC, SAB, SBC, SCA  
PFA, PFB, PFC, P3, Q3, S3, PF3

Accuracy: ±1%, typical

## Synchrophasors

Conformance: IEEE C37.118.1-2011 as amended by  
IEEE C37.118.1a-2014  
IEEE C37.118.2-2011

Accuracy: Level 1 as specified by IEEE C37.118

Measurements: Software selectable (P or M class)

Voltage: VA, VB, VC

Current: IA, IB, IC

Positive-Sequence: V1, I1

Periodic: Frequency and df/dt

Processing Rate: 120 Hz

## Triggered Waveform Recording

Sampling Rates: 1, 2, 4, 8, 24 kHz software selectable

Transient Fault Record Length

Individual Records as Long as:

24 seconds for 24 kHz
72 seconds for 8 kHz
144 seconds for 4 kHz
288 seconds for 2 kHz
576 seconds for 1 kHz

Prefault Time: 0.05 s to (max. event length – 0.05 s)

Data Format: IEEE C37.111-2013 COMTRADE

File Naming: IEEE C37.232 COMNAME

## Fuse

2.5 A, 125 V, Time Delay, Surface Mount

## Type Tests

### Environmental Tests

Enclosure Protection:	IEC 60255-27:2013 (Type 1 enclosure required for full compliance to IEC 60255-27) IEC 60529:1989 + A1:1999 + A2:2013 IP4X, excluding the terminal blocks
Vibration Resistance:	IEC 60255-21-1:1988 Vibration Endurance, Severity: Class 2 Vibration Response, Severity: Class 2
Shock Resistance:	IEC 60255-21-2:1988 Bump Test, Severity: Class 1 Shock Withstand, Severity: Class 1 Shock Response, Severity: Class 2
Seismic:	IEC 60255-21-3:1993 Quake Response, Severity: Class 2
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, 95% relative humidity
Damp Heat, Steady State:	EN 60068-2-78:2001

### Power Supply Immunity

Voltage Dips and Interruptions:	IEC 60255-26:2013 IEC 61000-4-11:2004 IEC 61000-4-29:2000
Ripple:	IEC 60255-26:2013 IEC 61000-4-17:1999 + A1:2001 + A2:2008
Gradual Shutdown and Startup:	IEC 60255-26:2013
Discharge of Capacitors:	IEC 60255-27:2013
Reverse Polarity and Slow Ramp:	IEC 60255-27:2013

### Dielectric Strength and Impulse Tests

Impulse:	EN 60255-27:2013 Impulse Severity: 5 kV IEEE C37.90-2005 Severity Level: 0.5 J, 5 kV
Dielectric (HiPot):	IEC 60255-27:2013 IEEE C37.90-2005 Dielectric Withstand Severity: 2.5 kV <sub>RMS</sub> for 1 minute

### Electromagnetic Compatibility Immunity

EMC Immunity:	EN 60255-26:2013 Environmental Severity Level: Zone A
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Electrostatic Discharge Immunity:	IEC 60255-26:2013 IEC 61000-4-2:2008 Severity Level: 6 kV contact discharge 8 kV air discharge IEEE C37.90.3-2001 Severity Level: 8 kV contact discharge 15 kV air discharge
Conducted RF Immunity:	IEC 60255-26:2013 IEC 61000-4-6:2008 Severity Level: 10 Vrms
Radiated RF Immunity:	IEC 60255-26:2013 IEC 61000-4-3:2006 + A1:2007 + A2:2010 Severity Level: 10 V/m unmodulated IEEE C37.90.2-2004 Severity Level: 20 V/m unmodulated
Surge Immunity:	IEC 60255-26:2013 Severity Level: Zone A IEC 61000-4-16:1998 + A2:2009 Severity Level: Zone 4
Fast Transient, Burst Immunity:	IEC 60255-26:2013 IEC 61000-4-4:2012 Severity Level: Zone A, 4 kV
Magnetic Field Immunity:	EN 61000-4-8:2010 Severity Level 5: 1 minute, 100 A/m Axion Applications: 3 seconds, 1000 A/m (±2.7deg and ±50 mA trip threshold on current channels) TiDL Applications: 3 seconds, 1000 A/m (50SQ1P = 0.07, ±50 mA trip threshold on instantaneous current elements) Severity Level 4: 3 seconds, 300 A/m <b>Note:</b> Performance evaluated with 1 A nominal current for both applications. EN 61000-4-9:1994 + A1:2001 Severity Level: 1000 A/m, Level 5 EN 61000-4-10:2001 Severity Level: 100 A/m at 100 kHz and 1 MHz, Level 5
Surge Withstand Capability Immunity:	IEC 60255-26:2013 IEC 61000-4-18:2006 + A1:2010 Severity Level: 2.5 kV common mode 1 kV differential mode IEEE C37.90.1-2002 Severity Level: 2.5 kV oscillatory 4.0 kV fast transient
Damped Oscillatory Waves Immunity:	EN 61000-4-18:2007 + A1:2010
<b>Emissions</b>	
Radiated and Conducted Emissions:	IEC 60255-26:2013 EN 55011:2009 for below 1 GHz EN 55022:2010 for above 1 GHz Severity Level: Class A

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## SCHWEITZER ENGINEERING LABORATORIES, INC.

2350 NE Hopkins Court • Pullman, WA 99163-5603 U.S.A.

Tel: +1.509.332.1890 • Fax: +1.509.332.7990

selinc.com • info@selinc.com

