SEL-2245-42 AC Protection Module

The SEL-2245-42 provides ac analog inputs for the SEL Axion®. 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. Configurations with an SEL-2245-42 as the right-most module in a backplane should have the backplane installed in a metal enclosure to meet Radiated RF Immunity Type Test requirements.

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.

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 with the slot you want on the chassis, and place the module on the bottom lip of the chassis, as *Figure 2* illustrates. The module is aligned properly when it rests entirely on the lip of the chassis.

Figure 2 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 3*). Finally, press the module firmly into the chassis and tighten the chassis retaining screw.

Figure 3 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* on page 2 for ac analog input ratings and to *Figure 4* 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.

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.

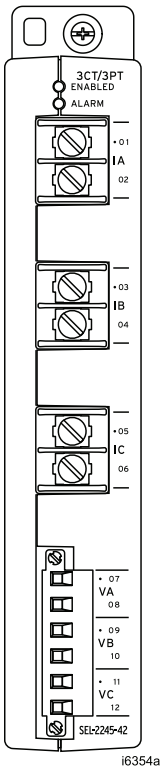

Figure 4 CT/PT Analog Inputs

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

UKCA Mark

Product Standards

IEC 60255-26:2013 - Relays and Protection Equipment: EMC
IEC 60255-27:2014 - Relays and Protection Equipment: Safety
IEC 60825-2:2004 +A1:2007 +A2:2010 for fiber-optic communications
IEC 61850-3:2013 - Comm Systems for Power Utility Automation

General

Operating and Storage Temperature Range

–40° to +85°C (–40° to +185°F)
Units should be stored and transported in their original packaging.

Note: Operating temperature evaluated for UL ambient 0° to 40°C.

Operating Environment

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

Fuse Rating (Chassis Power)

Non-Serviceable:	2.5 A, 125 V, time-lag T

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 (±0.1 Hz for <2.5 cycles during transients)
Phase Rotation:	ABC, ACB
Input Configuration:	3-Wire Delta, 4-Wire Wye
Update Intervals	
Fundamental Metering:	250 Hz
RMS:	250 Hz, 1 cycle window
THD (15th Harmonic Limited):	250 Hz, 1 cycle window
Harmonics and THD (63rd Harmonic Limited):	10/12 cycle for 50/60 Hz system frequency

AC Current Channels

Nominal Current:	1 A_{RMS} or 5 A_{RMS} (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_{RMS}
Measurement Range:	0.1–20 A_{RMS}

Thermal Withstand Limit:	15 A_{RMS} continuous 500 A_{RMS} 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_{NOM} and current > 0.4 A ±1°, over full rated temperature range ±2°, worst case

RMS Measurement Accuracy

Magnitude:	±0.1%, typical, ±0.001A ±2%, worst case, ±0.001A
Burden:	<0.1 VA @ 67 V Impedance >500 kΩ
THD Accuracy (15th Harmonic Limited):	±5% of measurement plus ±0.25%

AC Voltage Channels

Rated Range:	67–240 V_{L-N}

Note: Rated Range refers to the IEEE C37.118 rating system.

Operational Range:	0–300 V_{L-N}
Accuracy Range:	6.7–300 V_{L-N}
Rated Insulation Voltage:	300 V_{L-N} continuous 600 V_{L-N} for ten seconds

Galvanic Isolated Channels

Channel-to-Ground and Channel-to-Channel:	2.5 kV_{RMS} 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_{NOM}, typical ±1° @ f_{NOM}, over full rated temperature range ±2° @ f_{NOM}, 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
THD Accuracy (15th Harmonic Limited):	±5% of measurement plus ±0.25%

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
Frequency Resolution:	±1.25 mHz*
Calculated Power Resolution:	±0.1%*

* Resolution values tested with 69 V voltage inputs, 0.6 A to 1 A current inputs, and 49.5 to 50.5 Hz frequency range.

Message Rates (60 Hz nominal):	1, 2, 4, 5, 10, 12, 15, 20, 30, 60, and 120* (messages/second)
Message Rates (50 Hz nominal):	1, 2, 5, 10, 25, 50, and 100* (messages/second)

* Message rates are supported on the SEL-2241-2, SEL-3350, SEL-3555, and SEL-3560.

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
Pre-Fault Time:	0.05 s to (max. event length – 0.05 s)
Data Format:	IEEE C37.111-2013 COMTRADE
File Naming:	IEEE C37.232 COMNAME

Harmonics

Processing Window:	10/12 cycle for 50/60 Hz system frequency
Measurement Bandwidth:	40–4000 Hz (63rd harmonic)

Accuracy Range

Fundamental Frequency:	40–70 Hz
Voltage (V_{fund}):	67–270 V
Current (I_{fund}):	0.5–18.0 A
Voltage Accuracy (40–3000 Hz):	±5% for measurements ≥1% of V_{fund} ±0.05% of V_{fund} for measurements <1% of V_{fund}
Current Accuracy (40–3000 Hz):	±5% for measurements ≥1% of I_{fund} ±0.15% of I_{fund} for measurements <1% of I_{fund}
THD Accuracy (63rd Harmonic Limited):	±5% typical

Note: Harmonic measurements are calculated as harmonic subgroups, representing the rms value of the spectral content within a 15 Hz band centered on the target harmonic frequency (7.5 Hz before and after). Interharmonic measurements are determined as interharmonic centered subgroups, which are the rms values of the spectral content between two harmonic subgroups. THD measurements are calculated as the ratio of the rms value of the harmonic subgroups, up to the 63rd harmonic, to the rms value of the subgroup associated with the fundamental frequency.

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 Withstand, 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, Operational and Cold, Storage:	IEC 60068-2-1:2007 –40°C, 16 hours
Dry Heat, Operational and Dry Heat, Storage:	IEC 60068-2-2:2007 +85°C, 16 hours
Damp Heat, Cyclic:	IEC 60068-2-30:2005 25° to 55°C, 6 cycles, 95% relative humidity
Damp Heat, Steady State:	IEC 60068-2-78:2012 93% RH and 55°C for 10 days
Change of Temperature:	IEC 60068-2-14:2009 1 deg. per minute, –40° and +85°C, 5 cycles

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_{RMS} for 1 minute

RFI and Interference Tests

EMC Immunity

Slow Damped Oscillatory Waves:	IEC 61000-4-18:2006 + A1:2010 Severity Level: 2.5 kV common mode 1 kV differential mode
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 **Note:** 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:	IEEE C37.90.1-2002 Severity Level: 2.5 kV oscillatory 4.0 kV fast transient

Emissions

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

Technical Support

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

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Notes

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