

Type Test Certificate

400 Series

SEL-400G
SEL-411L
SEL-451
SEL-487E

SEL-401
SEL-421
SEL-487B
SEL-487V

This document contains references to the test procedures followed by SEL to certify the product(s) specified above to national and international standards.

Taylor Blanc

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Date



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Type Test Certificate**

Product Family Standards

EMC; Measuring Relays and Protection Equipment	EN 60255-26:2013	Emissions: Class A Immunity: Zone A
Product Safety; Measuring Relays and Protection Equipment	EN 60255-27:2014	Indoor Use Overvoltage Category II Pollution Degree II Class I

Electromagnetic Compatibility (EMC); Emissions

Radiated Emissions	IEC 60255-26:2013 47 CFR Part 15.109 ICES-001, Issue 5 ICES-003, Issue 6 CISPR 11:2009 + A1:2010 CISPR 22:2008 CISPR 32:2015 ANSI C63.4:2014	Class A
Conducted Emissions	IEC 60255-26:2013 47 CFR Part 15.107 ICES-001, Issue 5 ICES-003, Issue 6 CISPR 11:2009 + A1:2010 CISPR 22:2008 CISPR 32:2015 ANSI C63.4:2014	Class A

Electromagnetic Compatibility (EMC); Immunity

IEEE Surge Withstand Capability	IEEE C37.90.1 – 2012	Damped Oscillatory (1 MHz): Power Input; CT; PT & I/O: ± 2.5 kV (CM & DM) Communication Ports: ± 2.5 kV (CM Only)
		Fast Transient (5 kHz): Power Input; CT; PT & I/O: ± 4.0 kV (CM & DM) Communication Ports: ± 4.0 kV (CM Only)
Electrostatic Discharge Immunity	IEC 61000-4-2:2008 IEEE C37.90.3 – 2001	Contact: ± 2; 4; 6; & 8 kV Air: ± 2; 4; 8; & 15 kV

**SEL- 400 Series
Type Test Certificate**

Electromagnetic Compatibility (EMC); Immunity

Radiated Immunity	IEC 61000-4-3:2006 + A1:2007 + A2:2010	10 V/m (r.m.s.); 80 MHz – 1 GHz; 1.4 GHz – 2.7 GHz: Swept; 80, 160, 380, 450, 900, 1850 & 2150 MHz: Spot (>15 V/m (r.m.s.) w/80 % AM 1 kHz sine wave)
	IEEE C37.90.2 – 2004	20 V/m (r.m.s.); 80 MHz – 1 GHz: Swept Frequency; 80, 160, 450, 900 MHz: Spot Frequency (>35 V/m (r.m.s.) w/80 % AM 1 kHz sine wave)
Fast Transient/Burst Immunity	IEC 61000-4-4:2012	Zone A: Power Input; I/O: ± 4.0 kV; 5 kHz Zone A: Communication Ports: ± 2.0 kV; 5 kHz
Surge Immunity	IEC 61000-4-5:2005	Zone A: ± 0.5 ; 1.0; 2.0 kV; (Line – Line) Zone A: ± 0.5 ; 1.0; 2.0; 4.0 kV; (Line – Earth) Zone A: ± 0.5 ; 1.0; 2.0; 4.0 kV; Communication Ports (Ethernet) Note: Cables connected to EIA-422, G.703, and IRIG-B communications ports shall be less than 10 m in length for Zone A compliance.
Conducted Immunity	IEC 61000-4-6:2013	20 V _{RMS} ; 150 kHz – 80 MHz: Swept Frequency; 27 MHz & 68 MHz: Spot Frequency (w/80% AM 1 kHz sine wave)
Power Frequency Magnetic Field Immunity	IEC 61000-4-8:2009	100 A/m; ≥ 60 Seconds; 50/60 Hz 1000 A/m 1 to 3 Seconds; 50/60 Hz
Pulse Magnetic Field Immunity	IEC 61000-4-9:2016	1000 A/m
Damped Oscillatory Magnetic Field Immunity	IEC 61000-4-10:2001	100 A/m; 100 kHz & 1 MHz
Power Frequency Immunity (DC Inputs)	IEC 60255-26:2013 Section 7.2.9 (IEC 61000-4-16:2015)	Zone A: Differential: 150 V _{RMS} Zone A: Common Mode: 300 V _{RMS}
Slow Damped Oscillatory Wave	IEC 61000-4-18:2006 + A1:2010	Common Mode: Power Input; CT; PT & I/O: ± 2.5 kV Communication Ports: ± 1.0 kV Differential Mode: Power Input; PT & I/O: ± 1.0 kV

**SEL- 400 Series
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Electromagnetic Compatibility (EMC); Immunity

	IEC 61000-4-11:2004	A.C Dips & Interruptions
	IEC 61000-4-29:2000	D.C. Dips & Interruptions
	IEC 61000-4-17:1999 + A1:2004 + A2:2009	15 % Ripple on D.C. Power Input
Power Supply Immunity	IEC 60255-26:2013; Clause 7.2.13	Gradual Shutdown/Start-up (D.C. Supply Only)
	IEC 60255-27:2014; Clause 5.1.3	Accessible & Non-accessible Capacitor Discharge
	IEC 60255-27:2014; Clause 10.6.6	Slow Ramp Down/Up & Reverse Polarity (D.C. Supply Only)

Environmental

Cold, Operational	IEC 60068-2-1:2007	Test Ad; -40 °C, ≥ 16 hours
Cold, Storage	IEC 60068-2-1:2007	Test Ab; -40 °C, ≥ 16 hours
Dry Heat, Operational	IEC 60068-2-2:2007	Test Bd; +85 °C, ≥ 16 hours
Dry Heat, Storage	IEC 60068-2-2:2007	Test Bb; +85 °C, ≥ 16 hours
Cyclic Temperature	IEC 60068-2-14:2014	Test Nb; -40 °C to +85 °C, 5 cycles
Damp Heat; Cyclic	IEC 60068-2-30:2005	Test Db; +25 °C to +55 °C; 6 cycles (24-hour cycle), 95 % Relative Humidity
Damp Heat Steady State	IEC 60068-2-78:2013	Test Cab; +40 °C, 93 % ± 3 % Relative Humidity; 10 days
Vibration	IEC 60255-21-1:1988	Class 2: Vibration Endurance Class 2: Vibration Response
Shock & Bump	IEC 60255-21-2:1988	Class 1: Shock Withstand Class 2: Shock Response Class 1: Bump
Seismic	IEC 60255-21-3:1993	Class 2: Quake Response

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Safety

Dielectric Strength	IEC 60255-27:2014; Clause 10.6.4 IEEE C37.90 – 2005	± 3.6 kV _{dc} : Power Supply; 2.5 K _{Vac} : Contact I/O & Analog Inputs; ± 2.2 kV _{dc} : IRIG-B <hr/> ± 1 kV _{dc} : Ethernet
Impulse Withstand	IEC 60255-27:2014; Clause 10.6.4 IEEE C37.90 – 2005	Common Mode: (0.5 J; 5 kV; 1.2/50 μ S) ± 1.0 kV: Ethernet ± 2.5 kV: IRIG-B ± 5.0 kV: Analog Inputs, Digital Inputs, Digital Outputs, Power Supply, and Battery Monitor <hr/> Differential: (0.5 J; 5 kV; 1.2/50 μ S) 0 kV: Analog Inputs, Ethernet, IRIG-B, Digital Inputs ± 5.0 kV: Standard Contact Outputs, Power Supply, and Battery Monitor +5.0 kV: Hybrid Contact Outputs
Protective Bonding Continuity	IEC 60255-27:2013, Section 10.6.4.5.2	40 A for 1 min
IP Code	IEC 60529:2001	Degree of Protection: IP4x
Laser Safety	IEC 60825-1:2014 IEC 60825-2:2004 + A1:2006 + A2:2010 21 CFR 1040.10	Class 1