SEL-734W and LINAM Wireless Current Sensor Data Sheet

Simplify Capacitor Bank Control

Key Features and Benefits

The SEL-734W Capacitor Bank Control pairs with the LINAM Wireless Current Sensor (WCS) to provide capacitor bank control for distribution systems. Capacitor banks are used to boost the voltage profile of the distribution system and to reduce line losses due to reactive power consumption, all while increasing system capacity. Using these devices together simplifies capacitor bank control by providing current measurements without the need for expensive and difficult to install line-post sensors.

- **Easy to Install.** The lightweight LINAM WCS can be installed on an overhead distribution line by using a single hot stick. There is no need to take an outage or do significant hotline work.
- **No Cables Required.** With the LINAM WCS, you no longer need to purchase and install expensive and complicated cabling along with a junction box for line-post current sensors.
- **Supports New Control Applications.** With the LINAM WCS, you can now measure line current at one point on the distribution system while operating a capacitor bank at another nearby point on the system. This is useful for situations where the capacitor bank is installed at the end of a radial feeder or on a tap, away from the main line. The SEL-734W is configured using customizable SELOGIC® control equations, meaning you can customize the control logic to fit your specific needs.
- **Accurate and Versatile.** The sensor measures current at 1.5 percent accuracy and can measure phase to within 1.5 degrees. This is well-suited for capacitor bank control applications with the SEL-734W. The device also measures and transmits harmonic data up to the 15th harmonic and fits a wide range of conductor sizes for voltages as high as 38 kV.

- **Ready for Retrofits.** Change out existing time and temperature-based capacitor bank controls with a more effective control strategy that includes measuring line current—without the barriers of high-cost wired sensors.
- **SEL DNA® (Distribution Network Automation) Ready.** Capacitor controls are integral to system-wide volt/VAR control schemes. The SEL-734W integrates seamlessly into system-wide distribution control schemes to linearize voltage profiles and minimize VAR-induced I_2R losses.
- **Auxiliary Power Supply to Power Accessories.** The SEL-734W can be configured with an optional 15 Vdc auxiliary power supply. The auxiliary power supply can be used to power accessories such as radios, clocks, and cellular routers.

Functional Overview

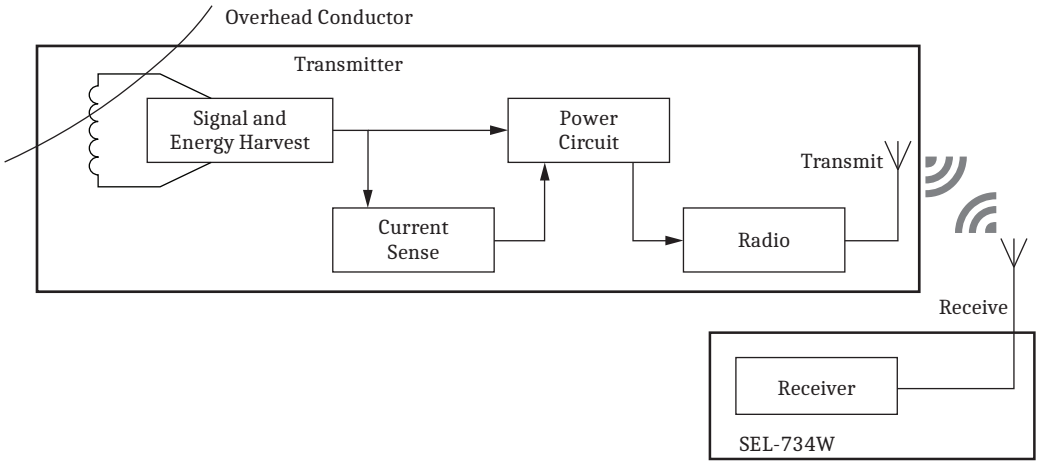


Figure 1 SEL-734W and LINAM Wireless Current Sensor System Overview

The SEL-734W and LINAM WCS system consists of as many as three LINAM Wireless Current Sensors, one per phase for a three-phase system, and one SEL-734W. The SEL-734W is a capacitor bank control that uses single-phase voltage and one or three LINAM WCS measurements to provide/perform three-pole control or ganged switching. The SEL-734W can use single-phase voltage to create the other two voltages along with three LINAM Wireless Current Sensors to provide three-phase switching decisions and power system monitoring. The SEL-734W is mounted in either a full-size or compact-size enclosure cabinet that is typically installed on a lower section of a power pole.

The LINAM WCS is a hot stick-installable current sensor that is mounted on the overhead distribution conductors with voltages as high as 38 kV. The LINAM WCS wakes up periodically, measures current (rms), computes harmonic content up to the 15th harmonic, and transmits the data to the SEL-734W capacitor bank controller.

The SEL-734W capacitor bank controller continuously samples voltage on the power lines (via post line sensor or a single phase CPT) and receives data from the wireless current sensors. Combining the data from the LINAM WCS and the voltage measurements, the SEL-734W accurately measures the phase angle between the system voltage and current. The controller uses both the measured voltage and current received from the LINAM WCS to calculate real and reactive power. The controller computes other quantities such as power factor and total harmonic distortion by using the received data from the LINAM WCS along with the measured voltage.

The SEL-734W capacitor bank controller can process data from one or three LINAM Wireless Current Sensors to implement a variety of capacitor bank control strategies. In a single-phase installation, current information from the sensor is used with voltage information from the control power transformer (CPT). In a three-phase installation, current is measured independently by using three LINAM Wireless Current Sensors, but voltage is still only measured on one phase. For three-phase switching decision and monitoring purposes, the SEL-734W creates the other two voltage phases of equal magnitude to the measured phase, but at 120 and –120 degrees rotation relative to the measured phase.

System Overview

Figure 2 provides an overview of the SEL-734W and LINAM WCS system.

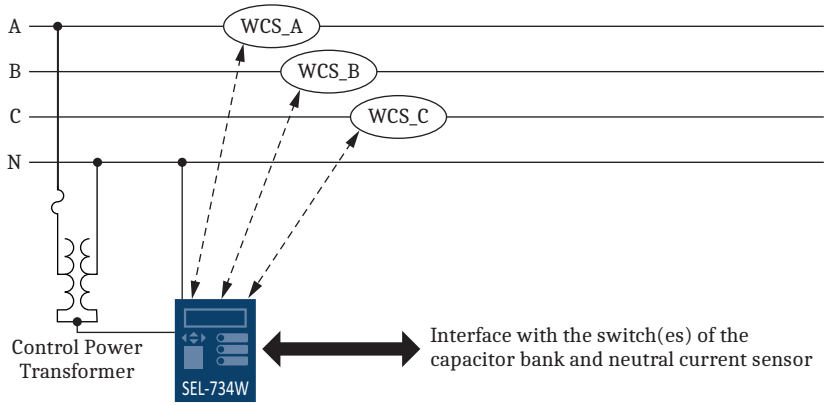


Figure 2 SEL-734W and LINAM Wireless Current Sensor System Overview

The LINAM WCS sends data periodically to the SEL-734W. The SEL-734W uses the received data along with measured voltage from the CPT to compute the quantities that allow the SEL-734W to make switching decisions, provide metering information and power quality information, and store events and load profiles. The SEL-734W controller supports the following capacitor bank automatic control strategies:

- Voltage control
- kVAR control
- Current control (compact enclosure only)
- Time-based control
- Temperature-based control
- Time with temperature override control
- Power factor control (compact enclosure only)

Features

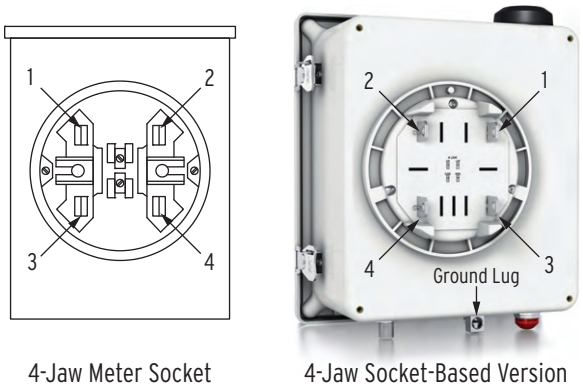
- SCADA, Auto, and Manual control modes
- Front-panel control and indicators
- Hunting prevention
- Adaptive voltage and kVAR processing
- Integrated 15 Vdc power supply for accessories
- Harmonic measurements and lockout
- Overvoltage lockout
- Door switch with SCADA alarm

Compact Enclosure Options

The SEL-734W is available in the following field interfaces:

- 4-Jaw socket-based
- 7-Pin connector-based (Connectorized)
- 7-Position terminal block (self-wired)

4-Jaw Socket-Based Models



4-Jaw Meter Socket 4-Jaw Socket-Based Version

Figure 3 Compact Enclosure Rear Plug and Meter Socket

The following table shows the Socket Stab configuration.

Table 1 Socket Stab Number and Function

1	+CPT
2	–CPT
3	OPEN
4	CLOSE

7-Pin Compact Enclosures

Connectorized

The enclosure contains one Amphenol MS1302A20-15P circular connector that routes all measurement and control signals.

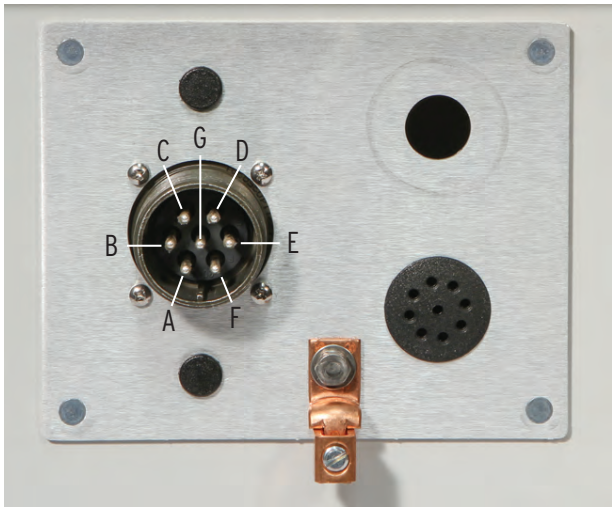


Figure 4 Bottom View of the Compact Connectorized Enclosure

Terminal Block (7-Position)

This enclosure contains an accessible terminal block, allowing for the end user to terminate their wires for measurement and control signals.

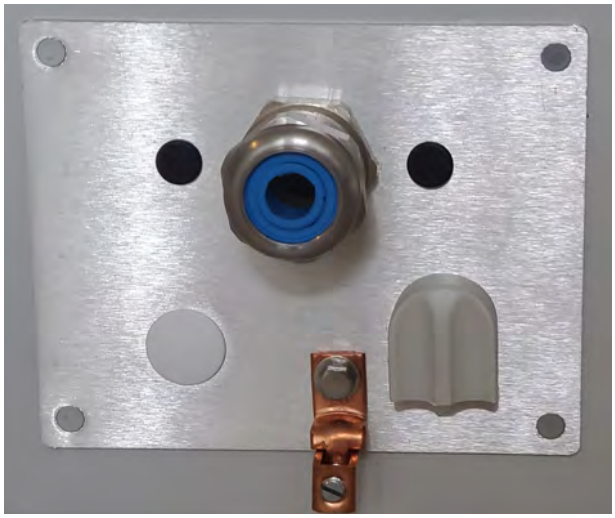


Figure 5 Bottom View of the Compact 7-Position Terminal Block Enclosure

Full-Size Enclosure Options

The SEL-734W Full Size Enclosure is available in the following field interfaces:

- Combined Sensor Connector
- Individual Sensor Connector

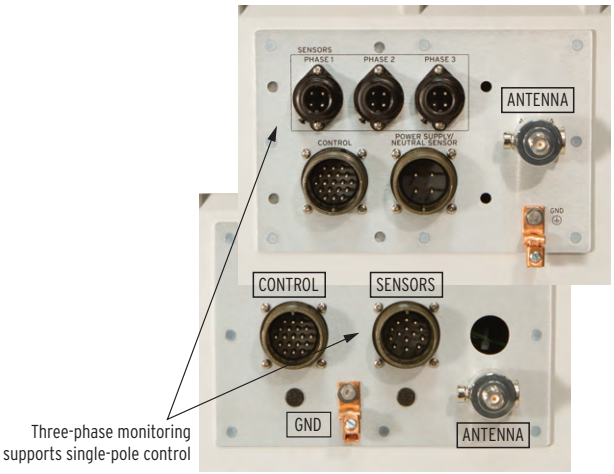


Figure 6 Full-Size Terminal Block Enclosure Interfaces

Combined Sensor Connector

The enclosure contains one 14-pin connector for all sensors and one 19-pin connector for three capacitor switches. The 14-pin connector connects to three primary voltage sensors. The 19-pin connector connects to three capacitor bank switches.

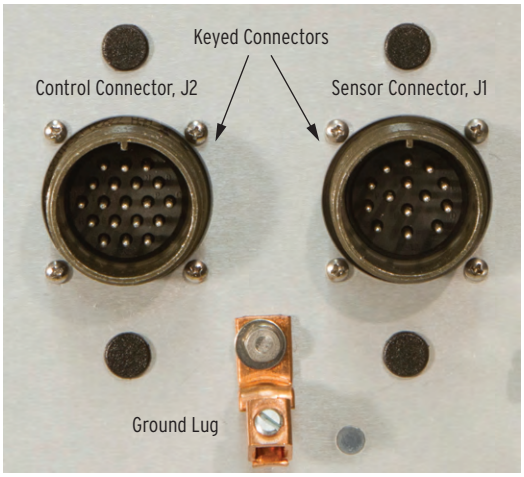


Figure 7 Combined Sensor Connector Option

Individual Sensor Connectors

Three 4-pin connectors, located on the bottom of the enclosure route each measurement signal to the SEL-734W.

Operators can choose to use one, two, or all three sensor inputs. Settings allow you to configure the SEL-734W for a different number of sensors. The enclosure contains the following connectors:

- Three 4-pin connectors connect to each primary voltage sensor
- One 4-pin connector connects to a 120 Vac control power transformer
- One 19-pin connector connects to three capacitor bank switches.

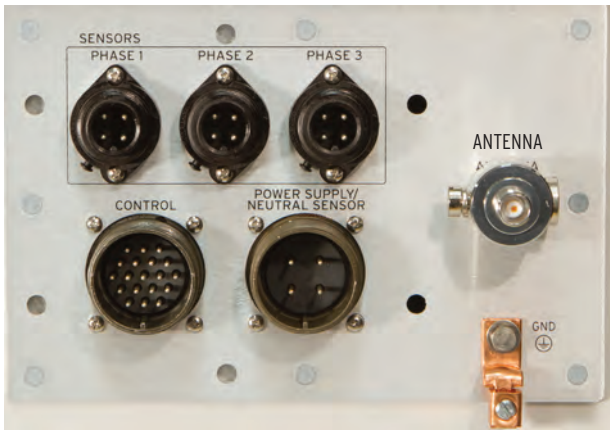
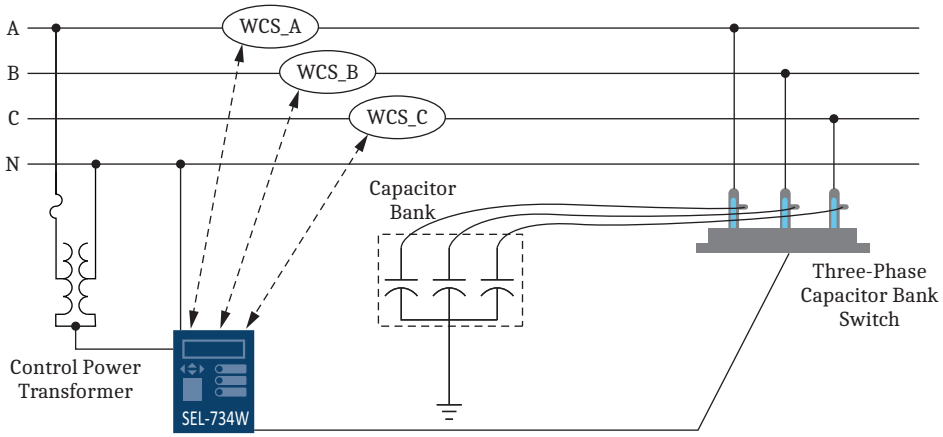


Figure 8 Individual Sensor Connector Option

Application Examples

Wireless Current Sensing and Ganged, Three-Phase Control



The SEL-734W is installed in an enclosure. The SEL-734W uses the CPT and one or three LINAM Wireless Current Sensors to compute power system quantities, determine events, and store load profile information. The SEL-734W uses the data to perform ganged switching.

LINAM WCS Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

General

Operating Temperature

–40° to +85°C (–40° to +185°F) @ 600 A Load Current
–40° to +60°C (–40° to +140°F) @ 1000 A Load Current

Storage Temperature

–40° to +85°C (–40° to +185°F)

Operating Environment

Pollution Degree:	2
Relative Humidity:	5%–95%, noncondensing
Maximum Altitude:	2000 m

Ingress Protection

IP67

Clamp Range (LINAM WCS)

6.35 mm to 31.75 mm (0.25 in to 1.25 in)

Dimensions

141.7 mm diameter x 177.0 mm height (5.58 inch diameter x 6.97 inch height)

Weight

Wireless Current Sensor: 0.85 kg (1.9 lb)

Overvoltage

Category III

Insulation Class

Class III

System

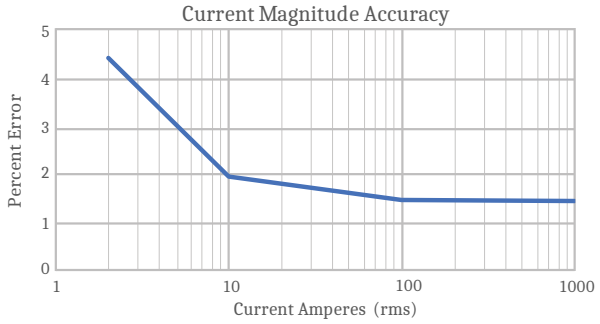
Power System Frequency Range

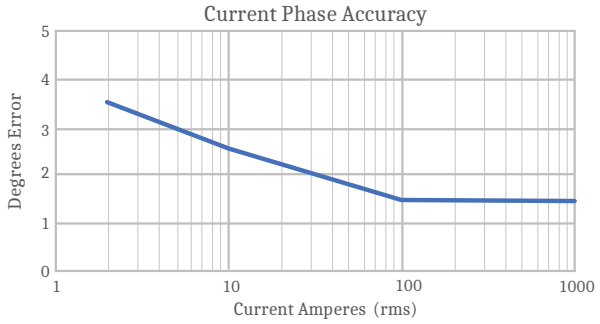
45–65 Hz

Typical Update Period vs Line Current

(See Table 6.1 in the SEL-734W Field Reference Guide)

Load Magnitude and Phase Measurement Accuracies





Maximum Voltage

38 kV (L-L)

Maximum Steady-State Load Current

1000 A (Thermal Rating)

Maximum Fault Current

25 kA for 10 cycles

Power

Minimum Load Current

2 A

Radio System

Frequency Band

902–928 MHz ISM band (U.S.A., Canada)

902.0–907.5 MHz and 915.0–928.0 MHz (Brazil)

LINAM WCS

TX Power (Effective Isotropic Radiated Power)

50 mW (17 dBm) peak,
40 mW (16 dBm) typical

Modulation

FSK

Link Range

1,500 ft line-of-sight (U.S.A. and Canada version)

Type Tests

Electromagnetic Compatibility Emissions

Radiated:	47 CFR Part 15.109 Class A

Electromagnetic Compatibility Immunity

Electrostatic Discharge:	IEC 61000-4-2:2008 IEEE C37.90.3-2001 Discharges: Indirect: ±8 kV Contact: ±8 kV Air: ±15 kV
Radiated:	IEEE C37.90.2-2004 20 V/m_{rms}; 80 MHz to 1 GHz >35 V/m_{rms} with 80% 1 kHz sine wave modulation
Conducted:	IEC 61000-4-6:2008 10 V_{rms}; 150 kHz to 80 MHz 80% 1 kHz sine wave modulation
Power Frequency Magnetic Field:	IEC 61000-4-8:2009 100 A/m; 50/60 Hz; ≥60 s 1000 A/m; 50/60 Hz; 1–3 s

Environmental

Cold:	IEC 60068-2-1:2007 Cold Profile Ad; –40°C; ≥16 hours; operational
Dry Heat:	IEC 60068-2-2:2007 Dry Heat Profile Bd; +85°C; ≥16 hours; operational
Damp Heat; Cyclic:	IEC 60068-2-30:2005 Damp Heat Profile Db; +25° to +55°C; relative humidity ≥93%; 6 cycles
Vibration:	IEC 60255-21-1:1988 Class 1 Vibration Endurance Class 2 Vibration Response
Shock and Bump:	IEC 60255-21-2:1988 Class 1 Shock Withstand Class 1 Bump Class 2 Shock Response
Seismic:	IEC 60255-21-3:1993 Class 2 Quake Response

Table 2 Certifications by Country

Country	Authority	Reference
U.S.A.	FCC	R34-900WCS
Brazil	Anatel	19047-22-07001
Canada	IC	4468A-900WCS

SEL-734W Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

General

Frequency and Rotation

60/50 Hz system frequency must be specified at time of order. ABC/ACB phase rotation is user settable.
Frequency tracking range: 45 to 65 Hz (V_A required for frequency tracking).

Power Supply

Continuous Operating Limits

125/250 Volt Supply:	85–264 Vac (50/60 Hz) 85–275 Vdc
VA Rating:	<40 VA/15 W maximum <20 VA/7 W typical

Interruption (IEC 60255-11:1979)

100 ms at 250 Vac/Vdc
50 ms at 125 Vac/Vdc

Ripple (IEC 60255-11:1979):	5% for dc inputs
Terminal Voltage Dropout:	<40 V within 1 minute of power removal
Rated Insulation Voltage (IEC 60664-1:2002):	300 Vac
Dielectric Test Voltage:	2.8 kVdc
Rated Impulse Voltage (IEC 60664-1:2002):	4000 V

Radio System

SEL-734W Receiver Card

Antenna Connector:	SMA, 50 Ω
RX Sensitivity (1% Error Rate):	–85 dBm

Note: For Brazil units, Network IDs 12–16 have reduced receive sensitivity. These Network IDs should only be used when IDs 1–11 are unavailable and the LINAM WCS is directly overhead.

15 Vdc Integrated Power Supply

Continuous Operating Limits

Rated Input Voltage:	110–240 Vac (50/60 Hz) 110–250 Vdc
Input Voltage Range:	85–264 Vac (50/60 Hz) 85–275 Vdc
Input Current:	<1 A at 85 Vac <1 A at 85 Vdc
Output Voltage:	15 Vdc ±5% for accessories, as power supply only
Output Current:	2.75 A for accessories, as power supply only

Ride-Through Performance (With a 25 W Auxiliary Load)

120 Vac Input:	50 ms
125 Vdc Input:	20 ms

Safety

Isolation Rating:	2.5 kVac minimum at 60 Hz
Insulation Rating:	300 Vrms (IEC 60664-2:2002)
Impulse Rating:	4 kVpk (1.2/50 µs per IEC 60664-1:2002)
Overvoltage Category:	II (IEC 60664-1:2000)
Insulation Type:	Reinforced for Input-to-Output (IEC 60664-1:2000) Basic for Input-to-Input (IEC 60664-1:2000)

Compact Enclosure Output Contacts

Output ratings were determined with IEC 60255-23:1994, using the simplified method of assessment.

Make Rating:	250 Vdc, 7.2 kVA (Cos theta = 1), 30 A per IEEE C37.90-1989
Carry:	8 A at 120 Vac, 50/60 Hz
Durability:	>100,000 cycles for: Three motor-operated switches as high as 1/4 HP each Three solenoid-operated switches as high as 12 A each
Pickup/Dropout Time:	<35 ms
Maximum Operating Voltage:	240 V
Rated Insulation Voltage:	300 V

Physical

Operating Temperature

SEL-734W Device:	IEC 60068-2: –40° to +85°C (–40° to +185°F)
LCD:	–20° to +70°C (–4° to +158°F)
Device in Compact Enclosure	With Integrated 15 Vdc Power Supply
0 W of Accessories:	–40° to +65°C (–40° to +149°F)
15 W of Accessories:	–40° to +60°C (–40° to +140°F)
40 W of Accessories:	–40° to +50°C (–40° to +122°F)
Without Direct Sunlight:	Increase max. temperatures by 15°C (27°F)

Operating Environment

Pollution Degree:	2 (SEL-734W Device)
Maximum Altitude:	2000 m
Maximum Humidity:	95% RH

Dimensions

SEL-734W Device Dimensions:	5.7" x 6.63" x 7.56"
Compact Enclosure Exterior Dimensions:	13.7" x 11.8" x 8.0"

Weight

4-Jaw Compact Enclosure Model:	8.8 kg (19.4 lb) (including SEL-2401 and SEL-3060)

Dielectric Test

Voltage Inputs:	2.2 kVac for 1 s
Optoisolated Inputs and Output Contacts:	2.2 kVac for 1 s
AC Power Supply:	3.11 kVdc for 1 s

Type Tests

Electromagnetic Compatibility

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

Electromagnetic Compatibility Immunity

Surge Withstand Capability:	IEEE C37.90.1-2002 Elec. Relays 2.5 kV oscillatory, 4 kV fast transient IEC 60255-22-1:2007 2.5 kV peak common, 2.5 kV peak differential mode, 1.0 kV peak common mode on communications ports
Power Frequency Magnetic Field Immunity:	IEC 61000-4-8:2009 1000 A/m for 3 seconds, 100 A/m for 1 minute
Pulse Magnetic Field Immunity:	IEC 61000-4-9:1993, 1000 A/m
Electrostatic Discharge Immunity:	IEC 61000-4-2:2008 Elec. disturbance, Section 2: ESD, Severity Level: 4 IEC 60255-22-2:2008 Elec. disturb. Section 2: ESD, Severity Level: 4; both polarities at Levels 1, 2, 3, and 4
Radiated Immunity:	IEC 61000-4-3:2010 Severity Level: X (15 V/m) IEC 60255-22-3:2007 Elec. relays, Section 3: Radiated electromagnetic field disturb., Severity Level: 3 (10 V/m)
Conducted Radio Frequency Immunity:	IEC 61000-4-6:2008 Severity Level: 3
Fast Transient/Burst Immunity:	IEC 61000-4-4:2011 Severity Level: 4

Environmental Tests

Cold:	IEC 60068-2-1:2007 Envir., Test Ad, Severity: 16 hours at –40°C
Dry Heat:	IEC 60068-2-2:2007 Envir., Part 2: Test Bd SEL-734W device, Severity: 16 hours at +85°C Device in Cabinet, Severity: 16 hours at +70°C
Damp Heat, Cyclic:	IEC 60068-2-30:2005 Basic envir., Part 2: Test Db Severity: 25° to 55°C, 6 cycles, 95% humidity
Enclosure Protection:	IEC 60529:2001, IP45
Seismic (Compact Enclosure Only):	IEC 60255-21-3:1993 Class 2 Response (Method A)
Radiated Emissions:	FCC Part 15; Class A

Safety

Dielectric Strength/Impulse:	IEC 60255-5:2000 Severity: 2500 Vac on analog inputs, contact inputs, and contact outputs 3100 Vdc on power supply

High-Voltage Line Surges

SEL-734W Device:	IEC 61000-4-5:2005 Level 4 (4 kV) on LEA voltage measurement inputs and power supply inputs. Level 2 (1 kV) on LEA current measurement inputs and auxiliary circuits
SEL-734W in Compact Socket-Based Enclosure:	IEEE C62.41:2002 Location Category B (6 kV) on LEA voltage measurement inputs and power supply inputs IEC 61000-4-5:2005 Level 2 (1 kV) on LEA current measurement inputs and auxiliary circuits
Impulse Voltage Test:	IEC 60060-1 4 kV on power supply, ac current inputs, and voltage inputs

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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