Key Features and Benefits

The SEL-734W Capacitor Bank Control pairs with the SEL-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 SEL-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 SEL-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 SEL-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 percent accuracy and can measure phase to within 4 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 I²R 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

The SEL-734W and SEL-WCS system consists of as many as three SEL-WCS devices, 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 SEL-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 SEL-WCS devices to provide three-phase switching decisions and power system monitoring. The SEL-734W is mounted in a compact-size enclosure cabinet that is typically installed on a lower section of a power pole.

The SEL-WCS is a hot stick-installable current sensor that is mounted on the overhead distribution conductors with voltages as high as 38 kV. The SEL-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 SEL-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 SEL-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 SEL-WCS along with the measured voltage.

The SEL-734W capacitor bank controller can process data from one or three SEL-WCSs 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 SEL-WCSs, 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 SEL-WCS system.*
The SEL-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 control strategies include voltage, kVAR, power factor, current, and time of day.

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

Interface

The SEL-734W has 4-Jaw Socket-Based interface. The following table shows the Socket Stab configuration.

<table>
<thead>
<tr>
<th>Table 1 Socket Stab Number and Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
</tr>
<tr>
<td>2</td>
</tr>
<tr>
<td>3</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

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 SEL-WCS devices to compute power system quantities, determine events, and store load profile information. The SEL-734W uses the data to perform ganged switching.
## SEL-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)

#### 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 (SEL-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 5.1 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)

#### SEL-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

### 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<sub>peak</sub>; 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
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 (VA 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

**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

- **Shock and Bump**
  - 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**

<table>
<thead>
<tr>
<th>Country</th>
<th>Authority</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>U.S.A.</td>
<td>FCC</td>
<td>R34-900WCS</td>
</tr>
<tr>
<td>Canada</td>
<td>IC</td>
<td>4468A-900WCS</td>
</tr>
</tbody>
</table>

**Radio System**

- **SEL-734W Receiver Card**
  - **Antenna Connector**: SMA, 50 Ω
  - **RX Sensitivity (1% Error Rate)**: –85 dBm

**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

**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 3/4 HP each
  - Three solenoid-operated switches as high as 12 A each

- **Pickup/Dropout Time**: <35 ms

**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 Immunity

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 disturbs, 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
Environ. Test Ad, Severity: 16 hours at –40°C

Environ., Part 2: Test Bd
SEL-734W device, Severity: 16 hours at +85°C

Damp Heat, Cyclic: IEC 60068-2-30:2005
Basic enir., 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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