SEL-734W and LINAM WCS

Capacitor Bank Control and LINAM Wireless Current Sensors

Field Reference Guide

20231206

SEL SCHWEITZER ENGINEERING LABORATORIES

PM734W-01

PM734W-01

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Preface

Overview

The SEL-734W Capacitor Bank Control is based on the SEL-734 Advanced Metering System platform. Devices ship with an outdoor-rated enclosure and are programmed with control strategies via SEL design templates.

The *SEL-734W Field Reference Guide* provides a general overview of the SEL-734W and describes the procedures for installation as a capacitor bank control. This guide also provides troubleshooting and testing methods.

The *SEL-734W Data Sheet* describes the SEL-734W and LINAM WCS system, the features and control strategies of the SEL-734W, as well as interface.

The *SEL-734W ACSELERATOR QuickSet Design Template Guide* describes the operation, details the settings, and contains logical diagrams for developers.

The *SEL-734 Instruction Manual* details all other features available in the SEL-734 device, including metering, power quality, and communications.

Safety Information

Dangers, Warnings, and Cautions

This manual uses three kinds of hazard statements, defined as follows:

⚠DANGER
Indicates an imminently hazardous situation that, if not avoided, **will** result in death or serious injury.

⚠WARNING
Indicates a potentially hazardous situation that, if not avoided, **could** result in death or serious injury.

⚠CAUTION
Indicates a potentially hazardous situation that, if not avoided, **may** result in minor or moderate injury or equipment damage.

Safety Symbols

The following symbols are often marked on SEL products.

	**⚠CAUTION** Refer to accompanying documents.	**⚠ATTENTION** Se reporter à la documentation.
	Earth (ground)	Terre
	Protective earth (ground)	Terre de protection

	Direct current	Courant continu
	Alternating current	Courant alternatif
	Both direct and alternating current	Courant continu et alternatif
	Instruction manual	Manuel d'instructions

Safety Marks

The following statements apply to this device.

General Safety Marks

⚠CAUTION There is danger of explosion if the battery is incorrectly replaced. Replace only with Rayovac no. BR2335 or equivalent recommended by manufacturer. See Owner's Manual for safety instructions. The battery used in this device may present a fire or chemical burn hazard if mistreated. Do not recharge, disassemble, heat above 100°C or incinerate. Dispose of used batteries according to the manufacturer's instructions. Keep battery out of reach of children.	**⚠ATTENTION** Une pile remplacée incorrectement pose des risques d'explosion. Remplacez seulement avec un Rayovac no BR2335 ou un produit équivalent recommandé par le fabricant. Voir le guide d'utilisateur pour les instructions de sécurité. La pile utilisée dans cet appareil peut présenter un risque d'incendie ou de brûlure chimique si vous en faites mauvais usage. Ne pas recharger, démonter, chauffer à plus de 100°C ou incinérer. Éliminez les vieilles piles suivant les instructions du fabricant. Gardez la pile hors de la portée des enfants.
For use in Pollution Degree 2 environment.	Pour l'utilisation dans un environnement de Degré de Pollution 2.
Ambient air temperature shall not exceed 40°C (104°F).	La température ambiante de l'air ne doit pas dépasser 40°C (104°F).
Terminal Ratings Wire Material Copper Tightening Torque Other Terminal Blocks: 0.8 Nm (7.0 in-lb)	Valeurs nominales des bornes Matériau de fil Cuivre Couple de Serrage Autres borniers : 0,8 Nm (7,0 livres-pouce)

Hazardous Locations Safety Marks

⚠WARNING – EXPLOSION HAZARD Open circuit before removing cover.	**⚠AVERTISSEMENT – DANGER D'EXPLOSION** Ouvrir le circuit avant de déposer le couvercle.
⚠WARNING – EXPLOSION HAZARD Substitution of components may impair suitability for Class I, Division 2.	**⚠AVERTISSEMENT – DANGER D'EXPLOSION** La substitution de composants peut détériorer la conformité à Classe I, Division 2.
Operating Temperature Range: –40°C to +85°C (–40°F to +185°F).	Plage de température de fonctionnement : –40°C à +85°C (–40°F à +185°F).
Hazardous Locations Operating Temperature Range: –20°C to +40°C (–4°F to +104°F).	Emplacements Plage de température de fonctionnement d'emplacements dangereux : –20°C à +40°C (–4°F à +104°F).

Other Safety Marks (Sheet 1 of 2)

⚠DANGER Disconnect or de-energize all external connections before opening this device. Contact with hazardous voltages and currents inside this device can cause electrical shock resulting in injury or death.	**⚠DANGER** Débrancher tous les raccordements externes avant d'ouvrir cet appareil. Tout contact avec des tensions ou courants internes à l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.
⚠DANGER Contact with instrument terminals can cause electrical shock that can result in injury or death.	**⚠DANGER** Tout contact avec les bornes de l'appareil peut causer un choc électrique pouvant entraîner des blessures ou la mort.

Other Safety Marks (Sheet 2 of 2)

⚠WARNING Use of this equipment in a manner other than specified in this manual can impair operator safety safeguards provided by this equipment.	**⚠AVERTISSEMENT** L'utilisation de cet appareil suivant des procédures différentes de celles indiquées dans ce manuel peut désarmer les dispositifs de protection d'opérateur normalement actifs sur cet équipement.
⚠WARNING Have only qualified personnel service this equipment. If you are not qualified to service this equipment, you can injure yourself or others, or cause equipment damage.	**⚠AVERTISSEMENT** Seules des personnes qualifiées peuvent travailler sur cet appareil. Si vous n'êtes pas qualifiés pour ce travail, vous pourriez vous blesser avec d'autres personnes ou endommager l'équipement.
⚠WARNING This device is shipped with default passwords. Default passwords should be changed to private passwords at installation. Failure to change each default password to a private password may allow unauthorized access. SEL shall not be responsible for any damage resulting from unauthorized access.	**⚠AVERTISSEMENT** Cet appareil est expédié avec des mots de passe par défaut. A l'installation, les mots de passe par défaut devront être changés pour des mots de passe confidentiels. Dans le cas contraire, un accès non-autorisé á l'équipement peut être possible. SEL décline toute responsabilité pour tout dommage résultant de cet accès non-autorisé.
⚠CAUTION Equipment components are sensitive to electrostatic discharge (ESD). Undetectable permanent damage can result if you do not use proper ESD procedures. Ground yourself, your work surface, and this equipment before removing any cover from this equipment. If your facility is not equipped to work with these components, contact SEL about returning this device and related SEL equipment for service.	**⚠ATTENTION** Les composants de cet équipement sont sensibles aux décharges électrostatiques (DES). Des dommages permanents non-décelables peuvent résulter de l'absence de précautions contre les DES. Raccordez-vous correctement à la terre, ainsi que la surface de travail et l'appareil avant d'en retirer un panneau. Si vous n'êtes pas équipés pour travailler avec ce type de composants, contacter SEL afin de retourner l'appareil pour un service en usine.
⚠CAUTION Use of controls or adjustments, or performance of procedures other than those specified herein, may result in hazardous radiation exposure.	**⚠ATTENTION** L'utilisation de commandes ou de réglages, ou l'application de tests de fonctionnement différents de ceux décrits ci-après peuvent entraîner l'exposition à des radiations dangereuses.
⚠CAUTION Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.	**⚠ATTENTION** Les changements ou modifications qui ne sont pas expressément approuvés par l'autorité responsable de se prononcer sur la conformité pourraient annuler le pouvoir de l'usager à actionner l'équipement.
⚠CAUTION Connect only 120 Vac nominal to the SEL-734W socket stab **VOLTAGES** connector.	**⚠ATTENTION** Connecter seulement 120 Vca nominal au connecteur de prise **VOLTAGES** (Tensions) du SEL-734W
⚠CAUTION Ground the SEL-734W Capacitor Bank Control cabinet chassis before making any other connections to the cabinet.	**⚠ATTENTION** Mettre à la terre le châssis de l'armoire du Contrôle de batterie de condensateurs SEL-734W avant de faire toute autre connexion à l'armoire.

General Information

Trademarks

All brand or product names appearing in this document are the trademark or registered trademark of their respective holders. No SEL trademarks may be used without written permission.

Trademarks appearing in this manual are shown in the following table.

SEL Trademarks	
ACSELERATOR QuickSet®	SELOGIC®

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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Internet: selinc.com/support
Email: info@selinc.com

SECTION 1

Introduction and Specifications

Overview

Figure 1.1 SEL-734W and LINAM WCS Capacitor Bank Control System

The SEL-734W Capacitor Bank Control pairs with LINAM Wireless Current Sensors (WCS) to provide capacitor bank control for distribution systems. The system uses as many as three LINAM WCS to measure line currents and accepts an optional fourth wired current sensor input for a neutral current channel. Voltage sensing is done by the control power transformer (CPT) or, optionally, by as many as three LEA voltage sensors in the SEL-734W Full-Size Enclosure. Additionally, you can use an optional temperature sensor to enable time- and temperature-based control. The LINAM WCS uses the measured quantities to operate a set of capacitor banks. The system helps improve power factor, provides VAR support, and improves the voltage profile by inserting or removing the capacitor bank from the distribution system. The system ultimately helps reduce line losses because of reactive power consumption and increases system capacity.

The LINAM WCS is a line-powered device that measures current. The single shot-gun-style hot stick installation and clamping mechanism allows for a quick installation that firmly attaches the sensor onto an overhead conductor. 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.

System Features and Benefits

The SEL-734W Compact Enclosure and LINAM WCS system measures voltage from a CPT (or line post sensor) and currents to make three-phase switching decisions for a variety of advanced control strategies such as voltage, kVAR, power factor, current, time, temperature, and time with temperature override. When only one voltage sensor is available, 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. With the Full-Size Enclosure, you can measure as many as three 120 Vac voltage sensors and accomplish single-phase switching. The LINAM WCS sends current data periodically to the SEL-734W. The SEL-734W uses the received data along with measured voltage 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.

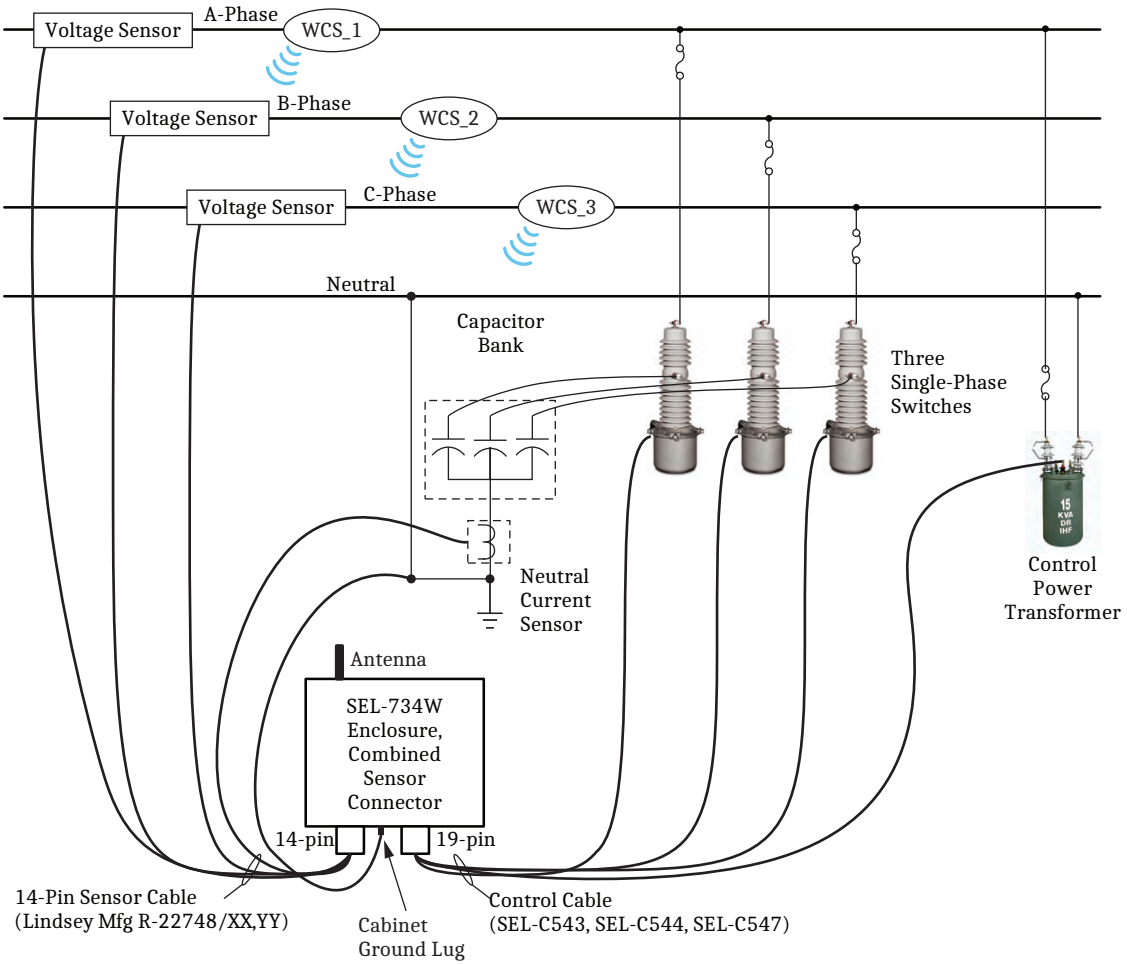


Figure 1.2 System Overview

Product Overview

LINAM WCS Product Overview

Figure 1.3 depicts the key components of the LINAM WCS. Each LINAM WCS mounts onto and monitors the line current on one phase. The LINAM WCS periodically sends the load data information, including the harmonics, to an SEL-734W.

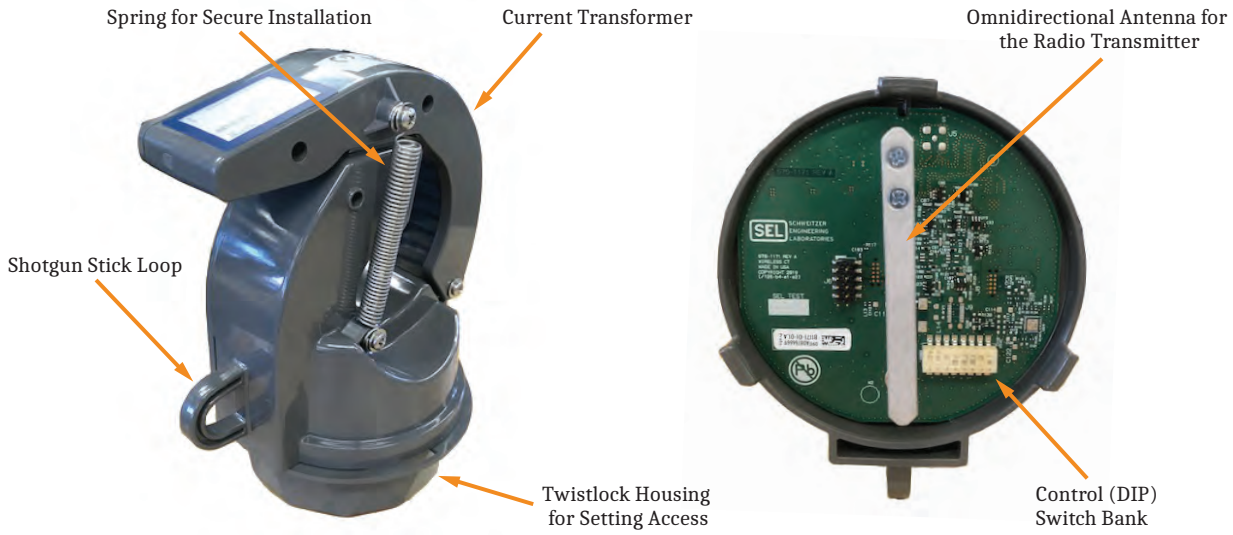


Figure 1.3 LINAM WCS Key Components

Shotgun Stick Loop and Spring

The shotgun stick loop and the spring simplify installation on overhead lines and hold the LINAM WCS in position. See *LINAM WCS* for more information.

Current Transformer (CT)

The LINAM WCS split-core CT harvests energy to power the device and accurately measures line current and harmonics of the current.

Integrated Radio

The 900 MHz radio module is mounted inside the LINAM WCS cone for environmental protection. The radio communicates to an SEL-734W to transmit line data.

Control (DIP) Switches

The control (DIP) switches inside the housing allow easy selection of the identification of each sensor. A LINAM WCS has a set of four control (DIP) switches for a network ID, two control (DIP) switches for a phase ID, and a single control (DIP) switch that determines whether a LINAM WCS sends the harmonic content information to the SEL-734W. Sending harmonics requires more energy, so the time between updates is greater if you configure the sensor to send harmonics.

SEL-734W Overview

SEL-734W Front Panel

This section describes the general front-panel functionality of the SEL-734W. The function of front-panel LEDs and pushbuttons are factory-programmed. Blank labels shipped with the device can be used to indicate new functionality. *Figure 1.4* depicts the front panel of the SEL-734W with default labels installed on the standalone device.

Figure 1.4 SEL-734W Front Panel Overview

ENABLED LED

This LED shows the diagnostics status of the SEL-734W. An illuminated **ENABLED** LED indicates that the SEL-734W is operating properly. If the **ENABLED** LED turns off, the SEL-734W requires service.

Configurable LEDs and Pushbuttons

All front-panel LEDs, except for the **ENABLED** LED, are configurable. The SEL-734W has four control pushbuttons and one **RESET** button. Custom labels on the front panel and settings in the device define the functionality of the pushbuttons and LEDs. Refer to the *SEL-734W ACSELERATOR QuickSet Design Template Guide* for details on the functionality of the capacitor bank control program.

Test Front-Panel LEDs

Press the **RESET** button to illuminate all front-panel LEDs for testing. This pushbutton is configurable and performs other functions for capacitor bank control. Refer to the *SEL-734W Template Reference Guide* for details on the programmed functionality of the **RESET** pushbutton.

Menu Pushbuttons

The menu pushbuttons provide access to the front-panel menu and are not configurable. You can use the menu to perform the following tasks:

- View the status and diagnostics of the SEL-734W
- View metering data
- View and change device settings
- View event data

Model, Options, and Accessories

Models

The SEL-734W is the model number for the wireless capacitor bank control.

You can select options for a 15 V accessory power supply, options for a field-installed radio or SEL-3061 Cellular Router, as well as options for one or three LINAM Wireless Current Sensors.

The LINAM WCS model number is SEL-8340. You can select options for the version that is certified in the USA and Canada, or the version that is certified for use in Brazil.

Accessories

Accessory	Part Number
EIA-232 to USB Communications Cable	Refer to the online MOT or contact an SEL representative or CSR for ordering information.
Pole Mounting Straps (9.375–12.25 inches)	915900448
Socket-Base Compact Enclosure Locking Ring	915900302

Optional Temperature Sensor

The SEL optional temperature sensor provides ambient air temperature sensing capabilities to the SEL-734W. You can use this with the Time/Temperature QuickSet settings template to perform advanced temperature and time-based control. Additionally, real-time temperature can be reported as an analog quantity in DNP3 communications within a distribution automation system.

The SEL-734W temperature is reported in Fahrenheit as analog quantity AI302. The settings template features two different time/temperature-based control programs that you can configure to enable automatically, allowing for seasonal variation control. SELOGIC control equations can use the temperature values for setting an alarm or supervising other control functions.

SEL-734W Rear Panel

A label on the top of the SEL-734W defines the function of each rear-panel terminal or communications port.

The rear panels are divided into six slots: Slot A, B, C, D, E, and Z. Terminals are designated by the slot letter and the terminal number. For example, Slot D terminals are designated D01 through D14.

Power Supply Board

Slot A contains the circuit board to power the SEL-734W. The SEL-734W is available with a 125/250 Vac/dc power supply, which comes with a green Euro connector.

Main CPU Board

Slot B contains the main CPU board. This slot also contains two EIA-232 communications ports. The Ethernet port is also located on this board.

Optional Communications Board

Slot C may contain an optional communications or analog input board. Typically, this slot is empty. When the SEL-734W is purchased with the optional temperature sensor, this slot is populated with the temperature sensor receiver input board.

Input/Output Board

Slot D contains an input/output (I/O) board. The board contains the output contacts to operate the capacitor bank switches. All output contacts on this board operate the capacitor bank switches. The number of output contact varies between a compact and full-size enclosure:

- For compact enclosures with ganged three-phase control, Slot D includes two hybrid digital outputs with 30 A current carry capability to open and close a ganged capacitor switch.
- For full-size enclosures with individual-phase switching, Slot D includes four standard contact outputs to switch to open and close single-phase capacitor switches. The remaining capacitor switch is opened and closed using contact outputs from Slot A.

Voltage and Current Measurement Board

Slot E contains the wireless sensor receiver board. As many as three voltage sensors can connect to this board. This board also carries a channel for LEA neutral current, which is available in every configuration of the SEL-734W besides the 4-jaw option. The SEL-734W wireless sensor receiver board has one LEA current sensor input (1 MΩ input impedance, 0.1–12.5 Vac) and three single-phase voltage sensor inputs (10 MΩ input impedance, 57–150 Vac).

In the Compact Enclosure, there is typically only one phase of sensing and the three capacitor switches are operated simultaneously. In these applications, you can use a single current-only neutral sensor and use the CPT voltage as the voltage sensing input.

In the Full-Size Enclosure, sensing and control of the three phases are typically independent, and you can use as many as three 120 Vac voltage sensors for individual voltage sensing.

Integrated 15 Vdc Power Supply Board

Slot Z optionally contains the integrated 15 Vdc power supply for accessories.

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) at 600 A load current
–40° to +60°C (–40° to +140°F) at 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

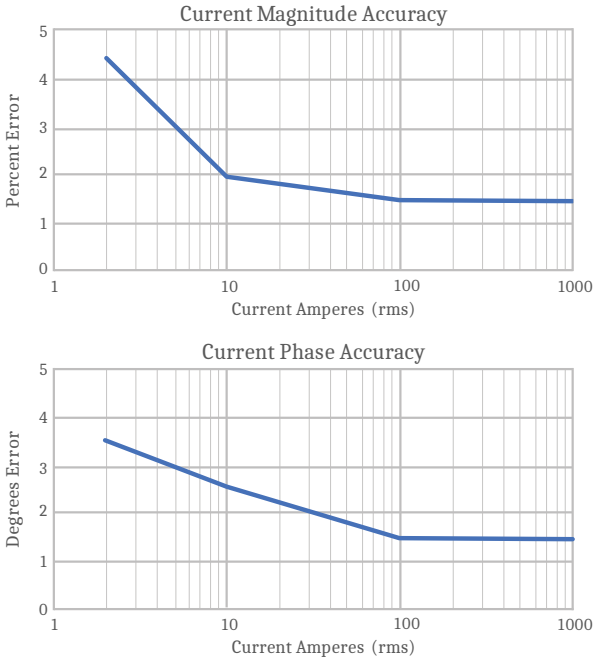
System

Power System Frequency Range

45–65 Hz

Typical Update Period vs Line Current (See *Table 6.1*)

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 5 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

Instantaneous Metering/Monitoring

Three-Phase Voltage Measurement Inputs

Three-Phase Wye (Line-to-Neutral) Voltage Measurement

Input Impedance: 10 MΩ

Range: 57–150 V

Accuracy: ±0.15%

Maximum Rating: 300 V continuous
600 V for 10 seconds

Current Measurement Inputs, Low-Energy Analog

Neutral Current Measurement Input on Select Models

Input Impedance: 1 MΩ

Range: 0.1–12.5 V

Accuracy: ±2%

Maximum Rating: 100 V continuous
200 V for 10 seconds

Optional Temperature Sensor

Range:	–40° to 85°C
Accuracy:	±1.5°C, 0° to 40°C ±2.5°C, –20° to 55°C

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
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

SECTION 2

Field Connections to the Enclosure

Overview

⚠CAUTION
Ground the SEL-734W Capacitor Bank Control cabinet before making any other connections to the cabinet.

This section describes the field connections to the enclosure. A description of the control and sensor cables is also given. A detailed drawing of the connector cable is provided in *Appendix D: Cable Drawings*.

Connections to the Full-Size Enclosure

SEL offers two versions of the Full-Size Enclosure. The Combined Sensor Connector version contains one 14-pin sensor connector and one 19-pin control connector. The Individual Sensor Connector version contains three 4-pin sensor connectors, one 19-pin control connector, and one 4-pin power supply/neutral sensor connector.

Combined Sensor Connector Version

Figure 2.1 shows the bottom view of the Full-Size Enclosure model with the combined sensor connector. All three phase sensors and the neutral sensor connect to the 14-pin connector on the bottom of the enclosure. Optionally, you can connect a neutral current sensor to terminal blocks inside the enclosure and route the cabling through openings on the bottom of the enclosure. The 19-pin connector routes the control power to the switches from the enclosure.

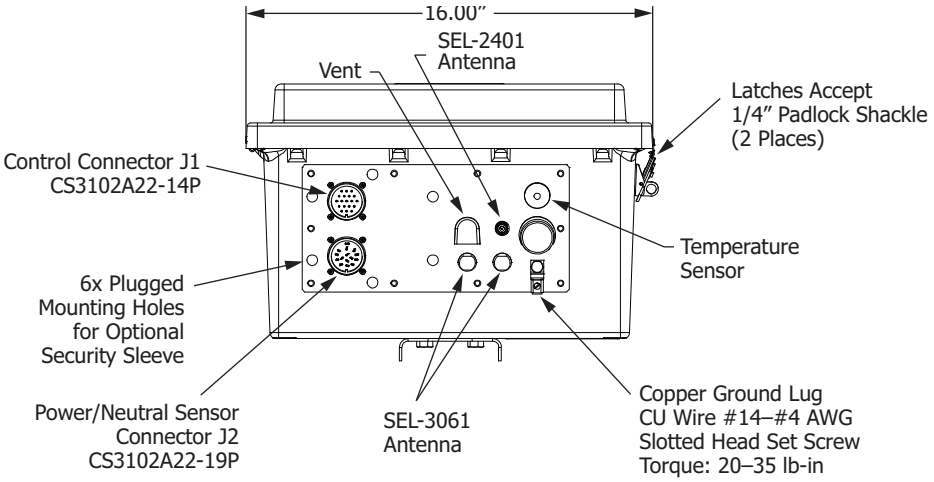


Figure 2.1 Bottom View of Enclosure With Combined Sensor Connector

19-Pin Control Connector J1

The control connector sends open and close signals to each capacitor bank switch, contains provisions to monitor the auxiliary (52a and 52b) contacts, and connects to the control power transformer. *Table 2.1* lists the functions of the connector's pins.

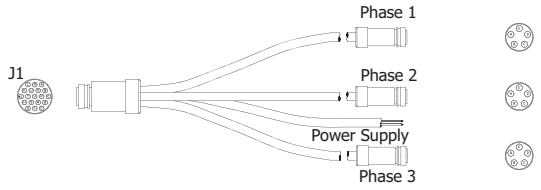
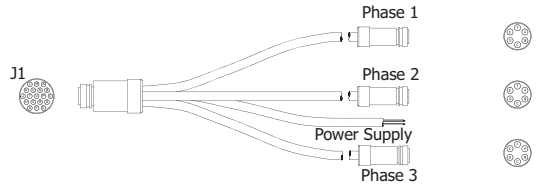
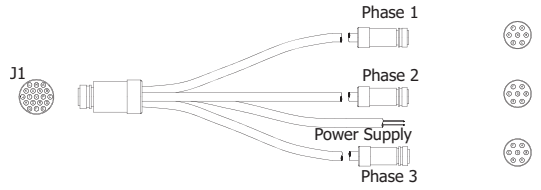
Table 2.1 Pinout of 19-Pin Control Connector fJ1 or Full-Size Enclosures With the Combined Sensor Connector

Pin Number	Description
A	120 Vac Control Power Transformer
B	Control Power Transformer Neutral
C	Open A-Phase
D	Close A-Phase
E	Reserved
F	Open B-Phase
G	Close B-Phase
H	Reserved
J	Open C-Phase
K	Close C-Phase
L	Reserved
M	A-Phase 52a Auxiliary Contact
N	A-Phase 52b Auxiliary Contact
P	B-Phase 52a Auxiliary Contact
R	B-Phase 52b Auxiliary Contact
S	C-Phase 52a Auxiliary Contact
T	C-Phase 52b Auxiliary Contact
U	Reserved
V	Reserved

Control Cables for Enclosures With the Combined Sensor Connector

Each of the following cables connect to the 19-pin control connector. Use *Table 2.2* to identify the control cable compatible with your installation.

Table 2.2 Control Cables for Full-Size Enclosures With the Combined Sensor Connector

SEL Cable	Cable Diagram	Notes
SEL-C543		➤ Connects to three switches and the control power transformer ➤ Compatible with Joslyn VersaVac and Cooper oil switches ➤ 5-pin (18-11S) female connectors ➤ Military standard 3106 style ➤ Supports 52b monitoring ➤ Compatible with security sleeve 915900311 ➤ Installation example: *Figure C.1*
SEL-C544		➤ Connects to three switches and the control power transformer ➤ Compatible with Joslyn VersaVac and Cooper oil switches ➤ 6-pin (18-12S) female connectors ➤ Military standard 3106 style ➤ Supports 52a and 52b monitoring ➤ Compatible with security sleeve 915900311 ➤ Installation example: *Figure C.1*
SEL-C547		➤ Connects to three switches and the control power transformer ➤ 7-pin (16S-1S) female connectors ➤ Supports 52a and 52b monitoring ➤ Compatible with security sleeve 915900311 ➤ Installation example: *Figure C.1*
SEL-C556		➤ Connects to an Eaton/Cooper junction box (CCR116K1) ➤ Controls three single-pole switches ➤ 19-pin (22-14S) female connector ➤ Supports 52a and 52b monitoring ➤ Compatible with security sleeve 9250011 ➤ Installation example: *Figure C.2*

14-Pin Combined Sensor Connector J2

The combined sensor connector routes the voltage from each phase to the SEL-734W. Optionally, you can connect a neutral sensor to the connector. *Table 2.3* lists the function of the connector's pins.

Table 2.3 Pinout of 14-Pin Combined Sensor Connector J2 for Full-Size Enclosures (Sheet 1 of 2)

Pin Number	Description
A	Reserved
B	Reserved
C	Neutral Sensor, Positive Polarity
D	Neutral Sensor, Common
E	A-Phase Voltage Sensor
F	B-Phase Voltage Sensor
G	C-Phase Voltage Sensor
H	Voltage Sensors Common

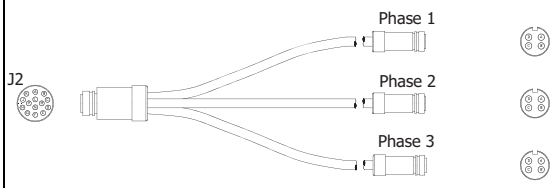
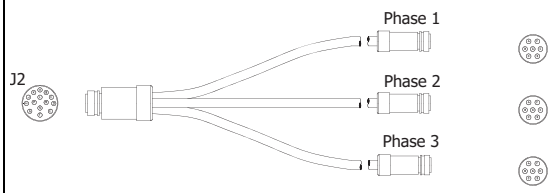
Table 2.3 Pinout of 14-Pin Combined Sensor Connector J2 for Full-Size Enclosures (Sheet 2 of 2)

Pin Number	Description
J	Reserved
K	Reserved
L	Reserved
M	Reserved
N	Reserved
P	Reserved

Sensor Cables for Enclosures With the Combined Sensor Connector

Each of the following cables connects to the 14-pin measurement connector. Use *Table 2.4* to identify the sensor cable that is compatible with your installation.

Table 2.4 Sensor Cables for Full-Size Enclosures With the Combined Sensor Connector

Cable	Cable Diagram	Notes
R-22748/XX,YY	Visit *selinc.com/products/73x/734b-full-enclosure/*	➤ Connects to three Lindsey Manufacturing sensors and one Lindsey Neutral Current Sensor ➤ 4-Pin (14S-2P) male connectors ➤ Installation example: *Figure C.1*
SEL-C529		➤ Connects to three Lindsey Manufacturing sensors ➤ Three 4-pin (14S-2P) male connectors ➤ Compatible with security sleeve 9250011 ➤ Installation example: *Figure C.2*
SEL-C536		➤ Connects to three Piedmont LSCV-SEL sensors ➤ Three 7-pin (16S-1P) male connectors ➤ Compatible with security sleeve 9250011 ➤ Installation example: *Figure C.2*
SEL-C559	Contact your SEL representative for the cable drawing.	➤ 14-Pin to 14-Pin pass through cable ➤ Connects to customer installed junction box ➤ Compatible with security sleeve 9250011 ➤ Installation example: *Figure C.4*

Individual Sensor Connector Versions

Figure 2.2 shows the bottom view of the enclosure with individual sensor connectors. This version contains five connectors located on the bottom.

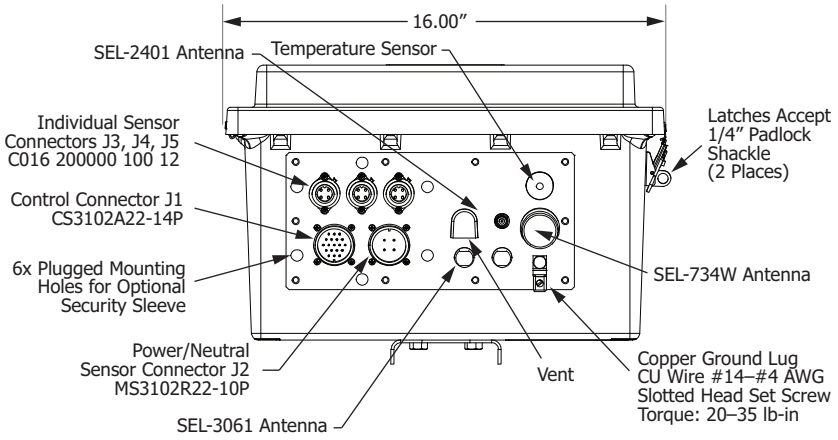


Figure 2.2 Bottom View of Enclosure With Individual Sensor Connectors

Control Connector J1

Connector J1 sends open and close signals to each capacitor bank switch and includes provisions to monitor the auxiliary (52a and 52b) contacts. *Table 2.5* lists the functions of the connector's pins.

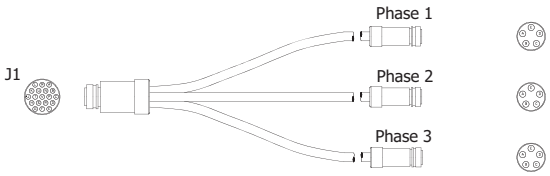
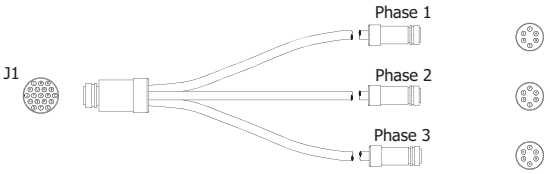
Table 2.5 Pinout of 19-Pin Control Connector J1 for Full-Size Enclosures With Individual Sensor Connectors

Pin Number	Description
A	Not Connected
B	System Neutral
C	Open A-Phase
D	Close A-Phase
E	Reserved
F	Open B-Phase
G	Close B-Phase
H	Reserved
J	Open C-Phase
K	Close C-Phase
L	Reserved
M	A-Phase 52a Auxiliary Contact
N	A-Phase 52b Auxiliary Contact
P	B-Phase 52a Auxiliary Contact
R	B-Phase 52b Auxiliary Contact
S	C-Phase 52a Auxiliary Contact
T	C-Phase 52b Auxiliary Contact
U	System Neutral
V	System Neutral

Control Cables for Enclosures With Individual Sensor Connectors

Each of the following cables connect to the 19-pin control connector. Use *Table 2.6* to identify the control cable that is compatible with your installation.

Table 2.6 Control Cables for Full-Size Enclosures With Individual Sensor Connectors

SEL Cable	Cable Diagram	Notes
SEL-C537		➤ Connects to three switches ➤ 5-pin female connector ➤ Military standard 3106 Style ➤ Insert arrangement 18-11S ➤ Installation example: *Figure C.4* ➤ Control power transformer connected separately
SEL-C538		➤ Connects to three switches ➤ 6-pin female connector ➤ Military standard 3106 Style ➤ Insert arrangement 18-12S ➤ Installation example: *Figure C.4* ➤ Control power transformer connected separately

4-Pin Sensor Connectors J3, J4, and J5

Connector **J3**, **J4**, and **J5** each connect to a single combination (measures voltage and current) sensor. Install the SEL-C530S shorting plug in unused connectors to minimize noise measurement. *Table 2.7* lists the functions of each pin.

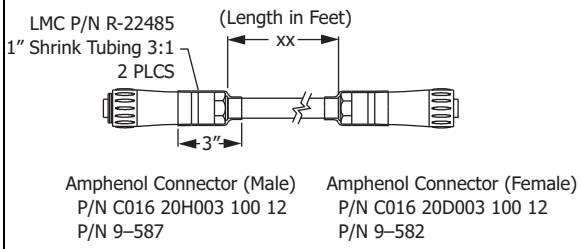
Table 2.7 Pinout of 4-Pin Individual Sensor Connectors J3, J4, and J5

Pin Number	Description
1	N/A
2	N/A
3	A-, B-, or C-Phase Voltage Sensor
4	Voltage Sensor Common

Sensor Cables for Enclosures With Individual Sensor Connectors

The following sensor cables connect to an individual phase sensor connector. Please use *Table 2.8* to identify the cable that is compatible with your installation.

Table 2.8 Sensor Cables for Full-Size Enclosures With Individual Sensor Connectors

Cable[a]	Cable Diagram	Notes
SEL-C530		➤ Connects to one Lindsey Manufacturing sensor ➤ 4-pin male connector, Ecomate C016 20H003 100 12 ➤ Alternative to the Lindsey 9-587/XX/9-582 cable ➤ Installation example: *Figure C.5* ➤ Compatible with security sleeves 915900304 and 915900224
Lindsey 9-587/XX/9-582		➤ Connects to one Lindsey Manufacturing sensor ➤ 4-pin male connector, Ecomate C016 20H003 100 12 ➤ Alternative to the SEL-C530 cable ➤ Installation example: *Figure C.5*
SEL-C530S	Contact your SEL representative for the cable diagram	➤ Sensor connector shorting plug ➤ Install into unused sensor connectors to prevent noise measurement ➤ Compatible with security sleeves 915900304 and 915900224

[a] These sensor cables are designed to work with combination voltage and current sensors. The SEL-734W receives current wirelessly, so the pins for phase current are not used. Contact SEL to discuss any unique connectors for voltage-only sensors for use with the SEL-734W.

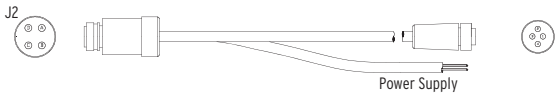
4-Pin Power Supply/Neutral Sensor Connector J2

Connector **J2** connects to the 120 Vac control power transformer and a neutral current sensor. *Table 2.9* lists the functions of the connector's pins.

Table 2.9 Pinout of Power Supply/Neutral Connector J2 for Full-Size Enclosures With Individual Sensor Connectors

Pin Number	Description
A	120 Vac Control Power Transformer
B	Control Power Transformer Neutral
C	Neutral Sensor, Positive Polarity
D	Neutral Sensor, Common

Table 2.10 Power Supply/Neutral Sensor Control Cables for Full-Size Enclosures With Individual Sensor Connectors

Cable	Cable Diagram	Notes
SEL-C532		➤ Connects to the control power transformer and a neutral sensor ➤ Wire pigtails for neutral sensor and control power transformer ➤ Installation example: *Figure C.4* ➤ Compatible with security sleeves 915900304 and 915900224
SEL-C539		➤ Connects to the cable of one Lindsey Manufacturing R-2298155 neutral sensor and the control power transformer ➤ 4-pin male connector ➤ Ecomate® C016 20H003 100 12, mates with Lindsey Sensor R-22981SS ➤ Installation example: *Figure C.5* ➤ Compatible with security sleeve 915900304

Connections to Compact Enclosures

Socket-Based Version

Figure 2.3 shows the rear of the socket-based enclosure, and *Table 2.11* shows the pinout of the socket stabs. SEL does not offer cables to install the socket-based enclosures. The socket-base should be wired to the field devices in accordance with *Table 2.11*.

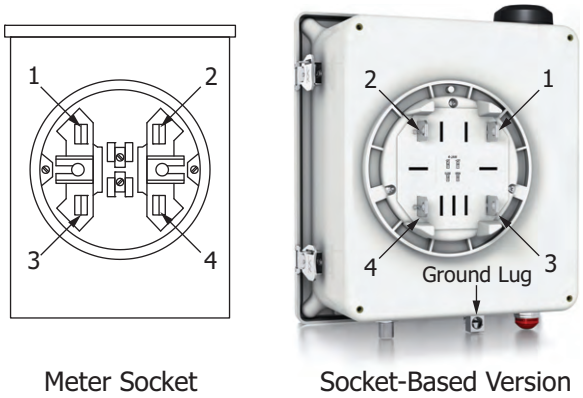


Figure 2.3 Rear of a Socket-Based Enclosure

Table 2.11 Socket Stab Configurations

1	+CPT
2	–CPT
3	OPEN
4	CLOSE

7-Pin Version

The Connectorized version of the Compact Enclosure connects to equipment in the field through one 7-pin connector located on the bottom of the enclosure.

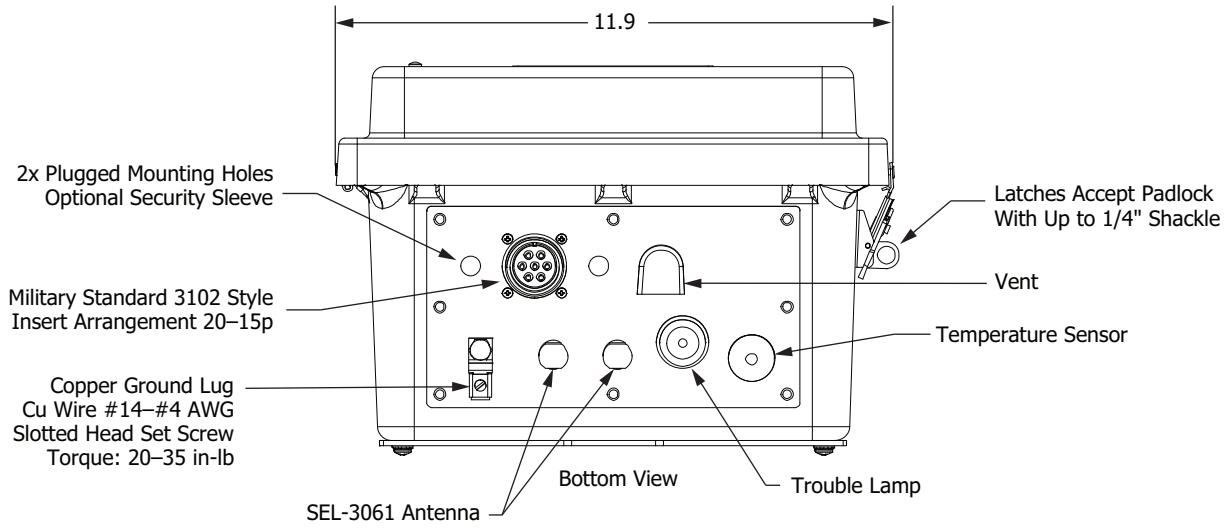


Figure 2.4 Bottom View of Connectorized Enclosure

The terminal block version of the Compact Enclosure allows you to make your own connections to the device and eliminates the need for a Connectorized cable at the enclosure. This is useful for retrofit applications where the cabling is already present.

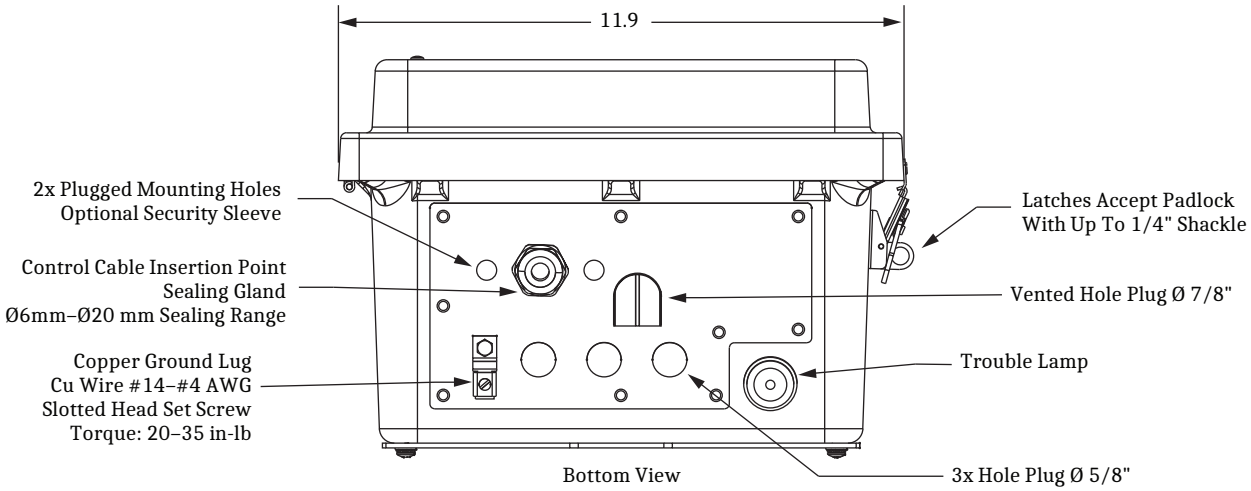


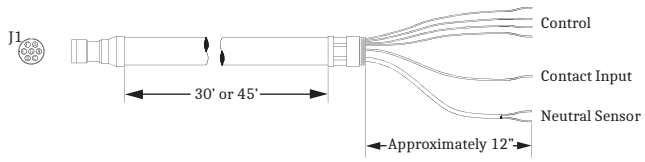
Figure 2.5 Bottom View of Terminal Block Enclosure

Table 2.12 Pinout of Control, Power, and Sensor Cable J1 for 7-Pin Connectorized Enclosure

Pin Number	Description
A	120 Vac Control Power Transformer, Positive Polarity
B	Open Operating Signal Output Contact
C	Close Operating Signal Output Contact
D	Contact Input IN402
E	Neutral Current Sensor Input, Positive Polarity
F	No Connection
G	120 Vac Control Power Transformer, Neutral

Table 2.13 shows the cable that is compatible with the 7-pin enclosure.

Table 2.13 Control and Sensor Cable for the 7-Pin Connectorized Enclosure

Cable	Cable Diagram	Notes
SEL-C558		➤ Bulkhead junction box connection with wire pigtails ➤ Connects to one neutral sensor, the CPT, a contact input, and the OPEN/CLOSE circuits of a three-pole switch ➤ Compatible with security sleeve 9250011

Getting Started

An SEL-734W ordered in an enclosure comes with a pre-installed design template. The template is also available on the SEL website. For more information, see the *SEL-734W Template Reference Guide*, and *Section 3: PC Software* of the *SEL-734 Instruction Manual*.

Methods to Verify Wireless Current Sensor Communications

This procedure explains how to check the metered values through different interfaces.

From the Front Panel

Step 1. Press **ENT** on the front panel of the SEL-734W.

Step 2. Select `Meter` and press **ENT**.

Step 3. Select `Instantaneous` and press **ENT**.

Step 4. Scroll through the menu to view the instantaneous measurements.

Using a Terminal Program

See *Section 3: PC Software* of the *SEL-734 Instruction Manual* on how to use ACSELERATOR QuickSet SEL-5030 Software.

Step 1. Establish communication to the SEL-734W.

Step 2. Select the QuickSet Terminal icon on the header ribbon, or open a terminal program and establish SEL ASCII communication to the device.

Step 3. Enter Access Level 1.

a. Enter the **ACC** command.

b. When prompted, enter the ACC password. The default password is OTTER.

Step 4. Enter the **MET** command. The SEL-734W will report the instantaneous voltage, current, and power.

Using the QuickSet HMI

Complete the following steps to check the current values and status of the device by using the QuickSet HMI.

Step 1. Establish communication to the SEL-734W.

Step 2. Select the HMI icon on the header ribbon. QuickSet opens the HMI window.

Step 3. Navigate to the Capacitor Bank Control Overview page from the list on the left of the screen. The Capacitor Bank Overview will open.

Step 4. The Capacitor Bank Overview shows the current values and controller status.

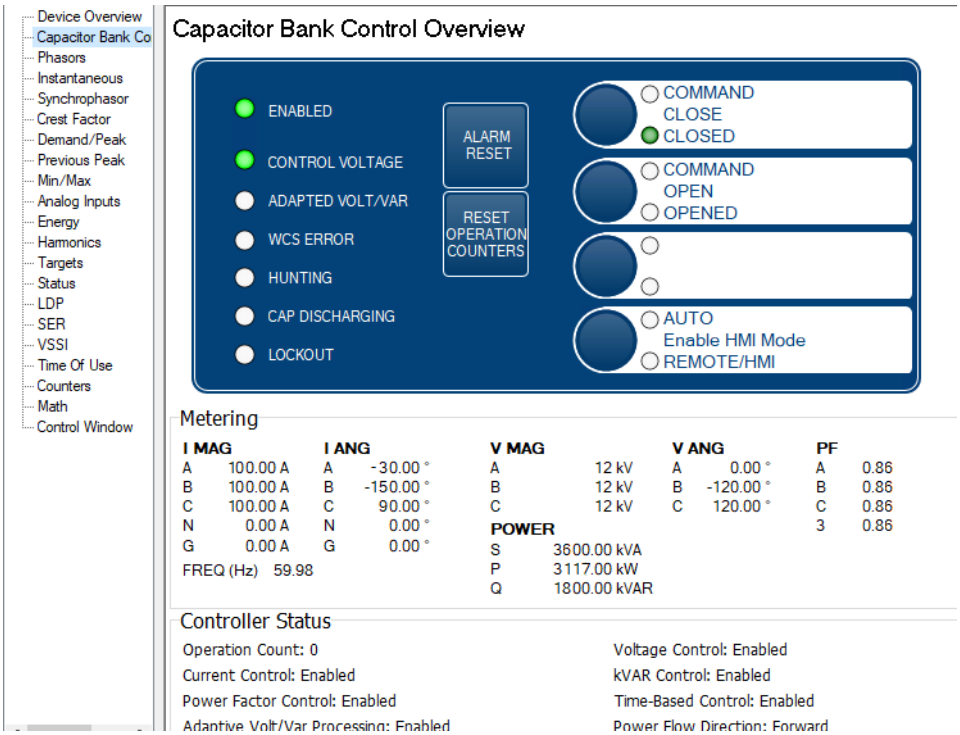


Figure 2.6 QuickSet HMI Capacitor Bank Control Overview

From the Front Terminal

Use a handheld volt meter connected to the front terminal test jacks to test the voltage.

Close and Open the Capacitor Bank From the Front Panel

The SEL-734W ships with the Manual mode enabled by default. Manual mode allows you to operate the capacitor bank from the front panel.

Step 1. Press the **MANUAL** pushbutton to ensure that Manual mode is enabled. You will know that Manual mode is enabled because the **MANUAL** LEDs illuminate.

Step 2. Press the **CLOSE** pushbutton. The **CLOSE COMMAND** LED should start flashing and the front-panel LCD should show the delayed time to close. Once the countdown reaches 0, the controller will close the capacitor bank.

Step 3. Verify that all three switches closed.

Step 4. Press the **OPEN** pushbutton. The **OPEN COMMAND** LED should start flashing and the front-panel LCD should show the delayed time to open. Once the countdown reaches 0, the controller will open the capacitor bank.

Close and Open the Capacitor Bank From QuickSet

The SEL-734W allows you to operate the capacitor bank from the QuickSet HMI page.

Step 1. Establish communication to the SEL-734W.

Step 2. Select the HMI icon on the header ribbon. QuickSet opens the HMI window.

Step 3. Navigate to the Capacitor Bank Control Overview page from the list on the left of the screen. The window will open.

Step 4. Select **Enable/Disable HMI Mode**.

Step 5. To close the capacitor bank switch, select the **CLOSE** pushbutton. The **CLOSE COMMAND** LED should start flashing.

Step 6. Verify that the **CLOSED** LED is on to indicate the switches are closed and no alarms are present.

Step 7. To open the capacitor bank switch, select the **OPEN** pushbutton. The **OPEN COMMAND** LED should start flashing.

Step 8. Verify that the **OPENED** LED is on to indicate the switches are open and no alarms are present.

View the Sequential Events Recorder

After the controller operates the switches for the first time, you should view the Sequential Events Recorder (SER). Follow the instructions below to view the SER from the QuickSet HMI.

Step 1. Open the QuickSet HMI.

Step 2. Navigate to the SER window.

Step 3. Choose the date range as appropriate.

Step 4. Select the **Update SER** button. QuickSet will poll the data from the SEL-734W and show the data in the window. QuickSet reports the SELOGIC element name in the SER report. Refer to the appropriate design template guide to determine the function of the SELOGIC element used for capacitor bank control. You can also complete the next steps to view an aliased SER report.

Step 5. Select the **Aliased SER** button to view an aliased SER report. This shows the SELOGIC element function, instead of the SELOGIC element name, to the capacitor bank control algorithm. Please refer to your design template guide for further details.

Validate SER

After the controller operates the bank for the first time, the sequence of events will be stored in memory. View the SER records as shown in the previous section, then use the following guidelines to ensure that the controller operated the capacitor bank properly.

The enclosure contains one open contact and one close contact to control one three-phase switch that is electrically connected. The enclosure does not connect to the switch auxiliary contacts. Use the following guidelines to ensure the controller operates the switches properly.

- Verify output contacts operate properly.
- Ensure each output contact remains asserted for the configured duration.
- After each operation, ensure the SEL-734W indicates the proper switch status.

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SECTION 3

Installing the Enclosure and Wireless Current Sensors

Overview

The following procedures describe the steps to install the SEL-734W Caoacitor Bank Control enclosure and LINAM WCS.

SEL-734W

Grounding the Enclosure

⚠WARNING
Always follow local utility grounding practices.

SEL recommends that the control power transformer serving the SEL-734W be on the same pole as the SEL-734W, as shown in *Figure 3.1*. All connections to the SEL-734W (e.g., ac supply from power transformer) must be routed in close proximity to, and parallel with, the ground conductor path for adequate surge protection. The connections and the ground path should be approximately equal in length. Primary lightning arrestors should be installed at the capacitor and at the control power transformer. All of these measures help reduce the possibility of equipment damage because of high voltages from surges.

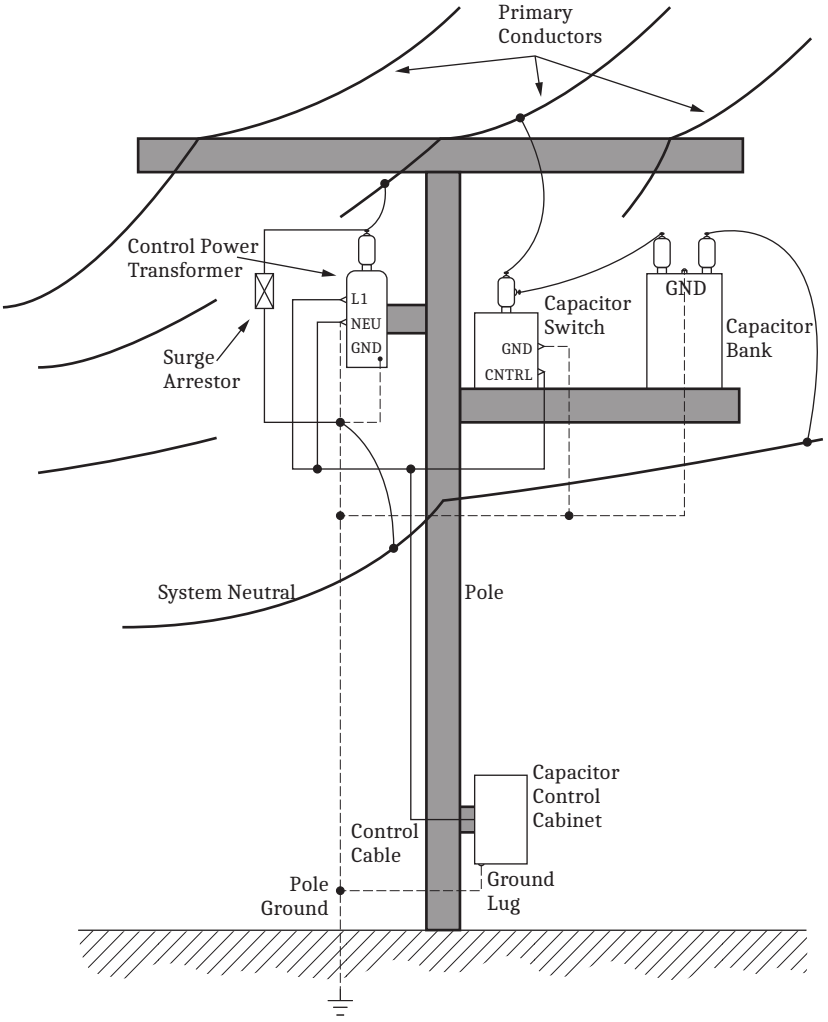

Figure 3.1 SEL-734W Required System Grounding

NOTE: Confirm that your cabinet provides the correct ground-to-neutral connection, or separation, as required by your systems design.

In cabinets with a ground lug, the ground lug is bonded to the chassis ground of the SEL-734W and all metal parts in the cabinet. The ground lug is not bonded to system neutral (see note). It is vital that the cabinet ground be connected to the local ground conductor through use of local utility practices.

Pole-Mounting the Full-Size and Compact 7-Pin Enclosures

The Full-Size Enclosure comes standard with a factory-installed pole mounting bracket. The pole-mounting bracket for the Compact 7-Pin Enclosure is available as an accessory. *Figure 3.2* and *Figure 3.3* show the front view of the enclosure with the optional pole-mounting bracket attached.

Required equipment:

- (2x) 5/8" or 3/4" lag bolts
- 15/16" or 1-1/8" wrench
- Drill

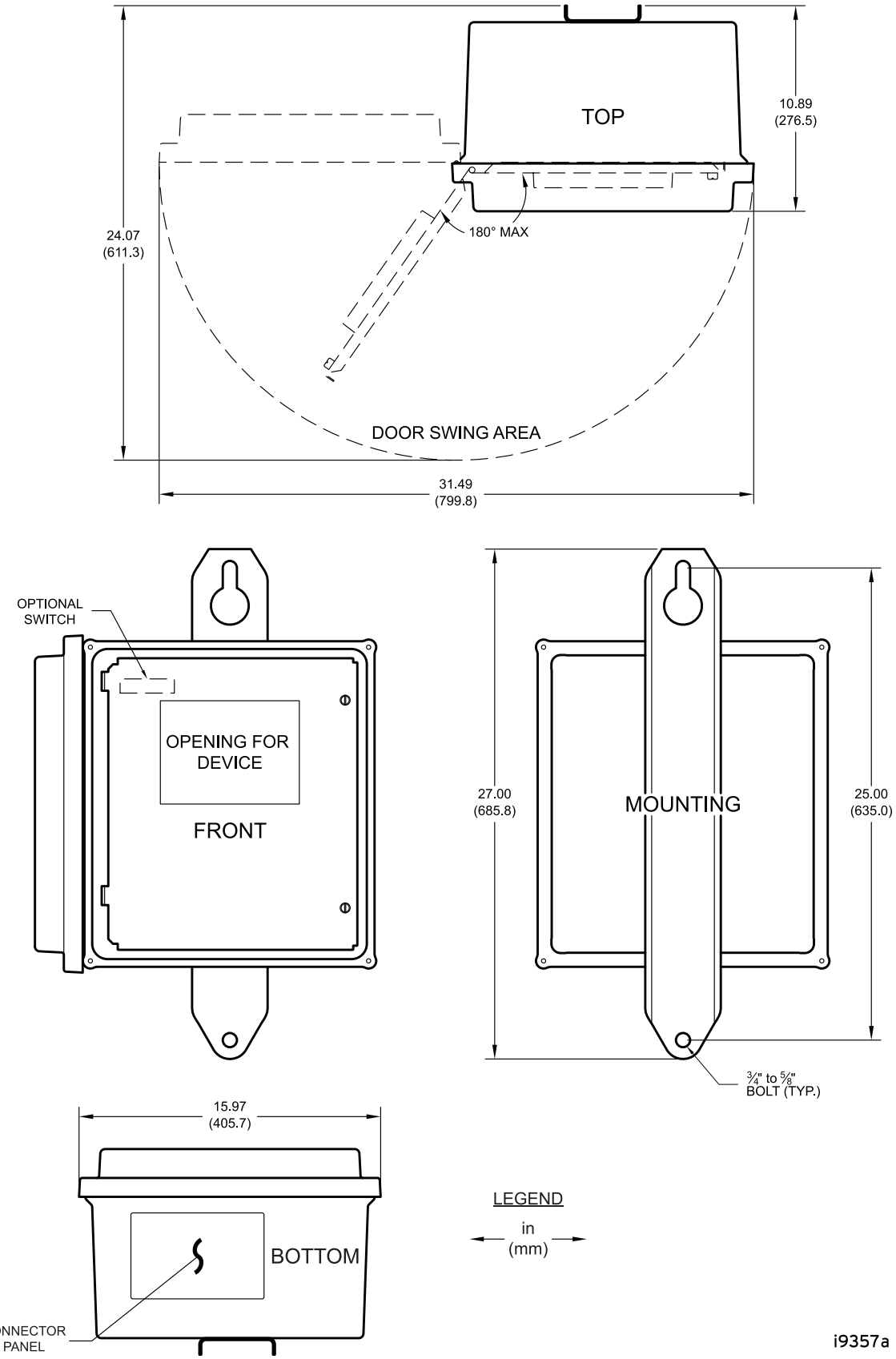

Figure 3.2 Full-Size Enclosure Mounting Dimensions

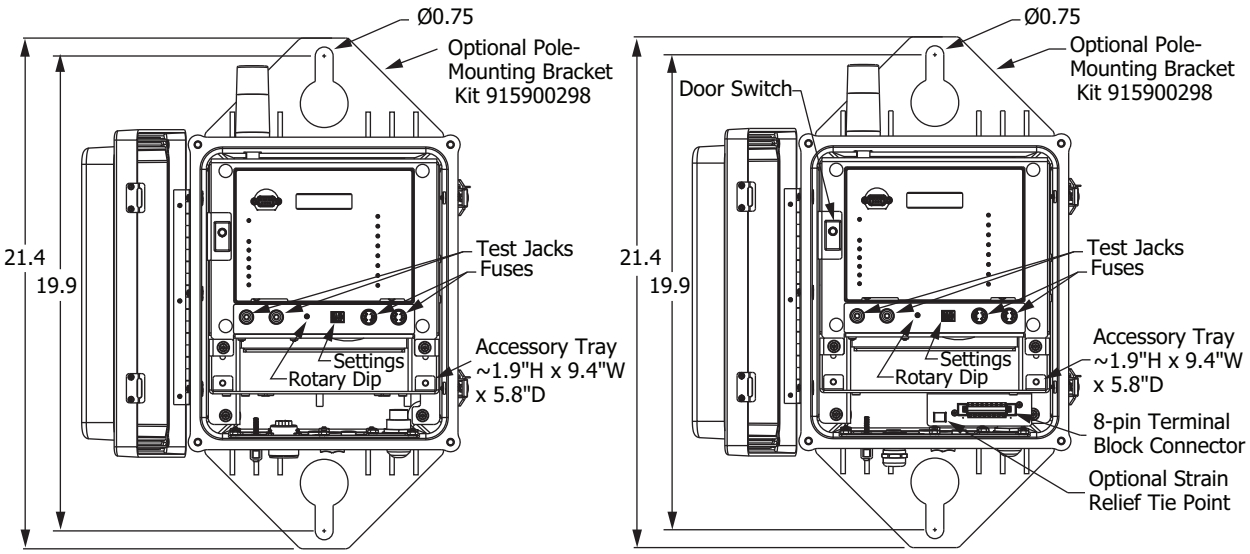

Figure 3.3 Compact 7-Pin Enclosure Mounting Dimensions

Step 1. Use the dimensions given in *Figure 3.2* and *Figure 3.3* and drill two pilot holes for the lag bolts.

Step 2. Install one lag bolt for the top mounting bracket.

Step 3. Hang the enclosure from the lag bolt.

Step 4. Install the other lag bolt into the bottom mounting bracket.

Step 5. Tighten both lag bolts.

Connecting Full-Size Enclosures to a Control Power Transformer and Switches

SEL offers control cables that connect directly to the capacitor bank switches and to the control power transformer (CPT). Refer to *Section 2: Field Connections to the Enclosure* to determine the correct cable for your installation.

The installation steps for the different enclosure styles vary slightly. Complete the appropriate steps for your enclosure style.

Full-Size Enclosure With the Combined Sensor Connector

Perform the following steps to connect the SEL-734W with the combined sensor connector to the capacitor bank switches and the CPT.

Step 1. Connect the enclosure to a local ground conductor.

Step 2. Remove or open the fuses inside of the enclosure.

Step 3. Use the appropriate control cable and connect the enclosure to the CPT and three capacitor bank switches.

Step 4. Install the fuses removed in *Step 2*.

Step 5. Ensure that the SEL-734W **ENABLED** LED illuminates.

Full-Size Enclosure With Individual Sensor Connectors

Perform the following steps to connect the SEL-734W with individual sensor connectors to the control power transformer and the capacitor bank switches.

Step 1. Connect the enclosure to a local ground connector.

Step 2. Remove or open the fuses inside of the enclosure.

Step 3. Connect the enclosure to the CPT by connecting the SEL-C532, SEL-C539, or a functionally equivalent cable from the **POWER SUPPLY/ NEUTRAL SENSOR** connector to the control power transformer connection.

Step 4. Connect the enclosure to the capacitor bank switches by connecting the SEL-C537, SEL-C538, or functionality equivalent cable from the **CONTROL** connector to three capacitor bank switches.

Step 5. Install the fuses removed in *Step 2*.

Step 6. Ensure that the SEL-734W **ENABLED** LED illuminates.

Connecting Full-Size Enclosures to the Sensors

The installation of enclosures with the combined measurement connector differs from enclosures with individual measurement connectors. Use the appropriate cable, as described in *Section 2: Field Connections to the Enclosure*, to connect the enclosure to the sensors.

Mounting Socket-Based Enclosures

Use a locking ring to mount and hold the enclosure to the meter socket base. *Figure 3.4* shows a sample locking ring, which is orderable as kit 915900302.

Figure 3.4 Meter Locking Ring for Socket-Based Enclosure

Connecting Socket-Based Enclosure to a Control Power Transformer and Switches

SEL does not provide cabling or installation equipment other than the locking ring for the socket-based enclosure models. Ensure that the meter socket is properly wired to the capacitor bank switches and sensors and that the enclosure is connected to the local ground conductor.

LINAM WCS

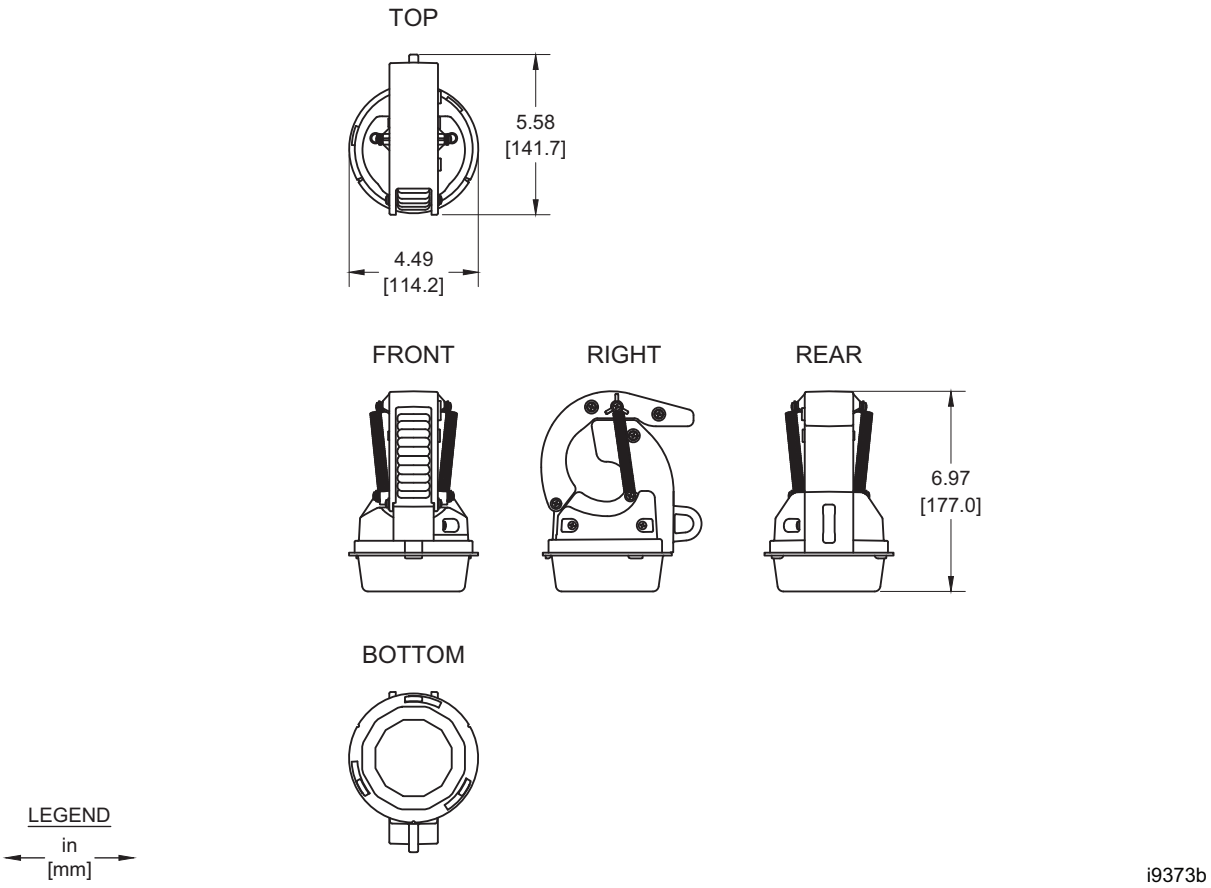

Figure 3.5 LINAM WCS Dimensions

Install the LINAM WCS on a distribution line by using an industry-standard shotgun stick.

Step 1. Determine the normal direction of current flow. Plan to install the LINAM WCS upstream from the capacitor bank with the attached arrow label pointed downstream towards the capacitor. The sensors are directional, so they must be oriented in this way to function properly.

Step 2. Use a shotgun stick to grasp the hook eye on the side of the LINAM WCS and place the device on the line so that the opening hangs over the line.

Step 3. Apply slight downward pressure while pulling the shotgun stick toward you until the device is closed around the line. The spring mechanism should be pushed in so that it wraps around the line.

Step 4. Apply slight upward pressure until the device is secured around the line as shown.

Step 5. Use the shotgun stick to adjust the transmitter orientation so that it is directly vertical. This is important to ensure the best propagation characteristics for the internal antenna. Check that the CT is solidly closed around the conductor.

Installation Recommendations

For single-phase LINAM WCS installations, use the following steps:

Step 1. Use the control (DIP) switches of the Phase Identification setting to configure the LINAM WCS as Phase I1. See *Table 5.1* and *Table 6.2* for controller and LINAM WCS Dip Switch settings.

Step 2. Install the LINAM WCS on the same power line where the CPT (or voltage sensor) is installed.

Determine the current direction of normal power flow, and verify the placement of the sensor to be upstream of the capacitor bank with the arrow pointed downstream towards the capacitor bank.

Step 3. By default, I1 and V1 are mapped to Phase A. If your WCS and your CPT are not on Phase A, adjust the phasing through the front-panel dip switches.

Step 4. If you know that you connected your CPT and WCS to Phase B or Phase C, use the controller DIP switch setting to map V1 and I1 to the appropriate phase.

Step 5. If the sensor was placed on the incorrect line, use the Controller Dip Switch settings to map the WCS to the correct phase.

NOTE: If you attempt the **TRI** command and any of the sensors do not report a current reading, it is possible that the sensor is either not closed around the line or the radio does not have sufficient line of sight.

NOTE: From the factory, it is assumed the WCS Phase Identification settings are mapped such that Phase I1 is representative of Phase A, Phase I2 is representative of Phase B, and Phase I3 is representative of Phase C.

NOTE: These steps assume an ABC phase rotation.

For three-phase LINAM WCS installations, use the following steps:

Step 1. Use the control (DIP) switches of the Phase Identification setting to configure one LINAM WCS as Phase I1, another LINAM WCS as Phase I2, and the last one as Phase I3. See *Table 5.1* and *Table 6.2* for controller and LINAM WCS Dip Switch settings.

Step 2. Determine the current direction of normal power flow, and verify the placement of the sensor to be upstream of the capacitor bank with the arrow pointed downstream towards the capacitor bank.

Step 3. Install the LINAM WCS on each phase. I1 should be installed on the phase assumed to be Phase A, I2 should be installed on the phase assumed to be Phase B, and I3 should be installed on the phase assumed to be Phase C.

Step 4. Use the front-panel interface to check your phase voltages and currents. Phase A voltage will be at 0 degrees. One of your currents should be at a phase angle close to 0 degrees with respect to Phase A voltage. That is your Phase A current. If it is not reporting as Phase A current, use the Controller Dip Switch settings to map the WCS to Phase A.

Step 5. One group of voltages and currents should be at a phase angle close to –120 degrees with respect to Phase A voltage. Those are your Phase B voltage and current. If this group is not reporting as Phase B, use the Controller Dip Switch settings to map these values to Phase B.

Step 6. One group of voltages and currents should be at a phase angle close to +120 degrees with respect to Phase A voltage. Those are your Phase C voltage and current. If this group is not reporting as Phase C, use the Controller Dip Switch settings to map these values to Phase C.

SECTION 4

Applications

Single-Phase Measurement and Ganged Switching

Figure 4.1 shows a single-measurement and ganged switching application. The SEL-734W uses one measured voltage, such as from a CPT, and one LINAM WCS to make switching decisions and provide power system monitoring.

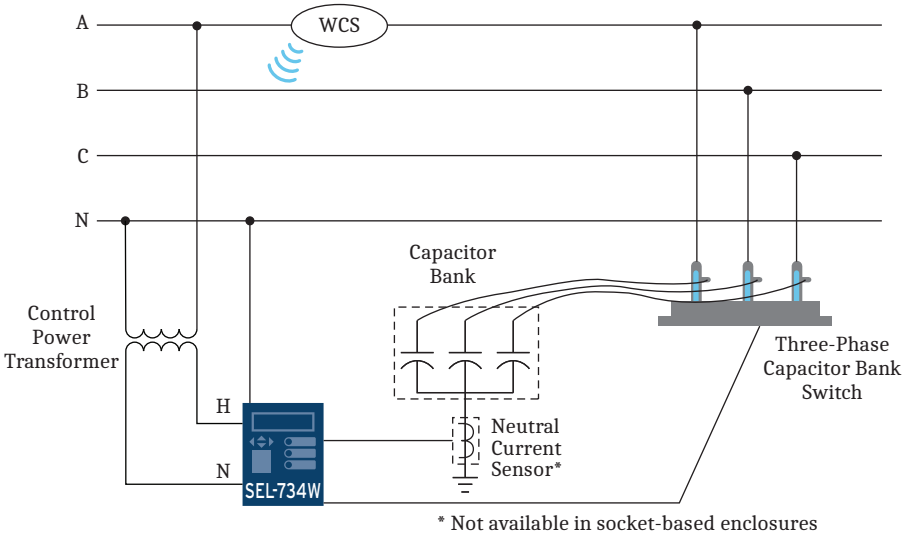

Figure 4.1 Single-Phase Application

Three-Phase Measurements and Ganged Switching

Figure 4.2 shows a three single-measurement and ganged switching application. The SEL-734W uses one measured voltage, such as from a CPT, and three LINAM Wireless Current Sensors to make three-phase switching decisions and provide power system monitoring.

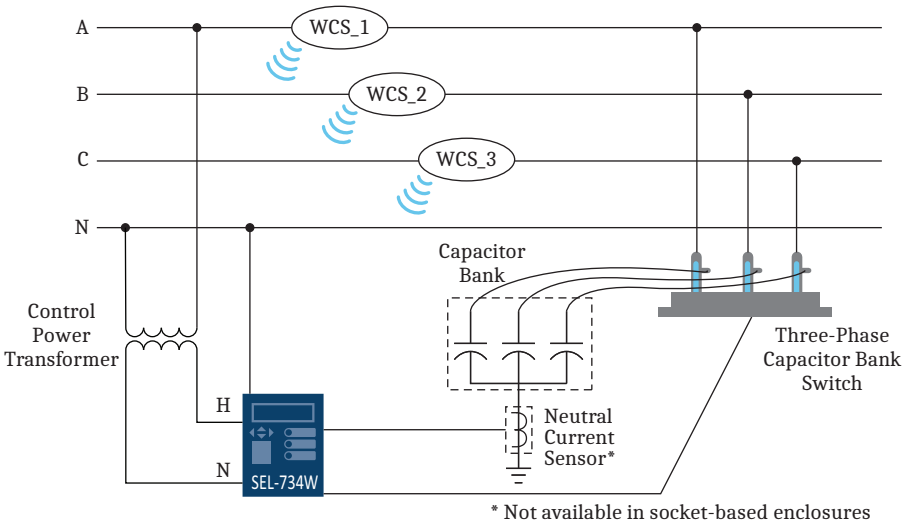

Figure 4.2 Three-Phase Application

Three-Phase Measurements and Single-Pole Switching

Figure 4.3 shows a three-phase measurement and single-pole switching application. The SEL-734W and LINAM WCS system measures voltage from a CPT (or line post sensor) and currents to make three-phase switching decisions for a variety of advanced control strategies such as VAR, current, and power factor. With the Full-Size Enclosure, you can measure as many as three voltage sensors and accomplish single-phase switching. The LINAM WCS sends data periodically to the SEL-734W. The SEL-734W uses the received data along with measured voltage from the CPT or voltage sensors 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. Additional control strategies include voltage and time and temperature.

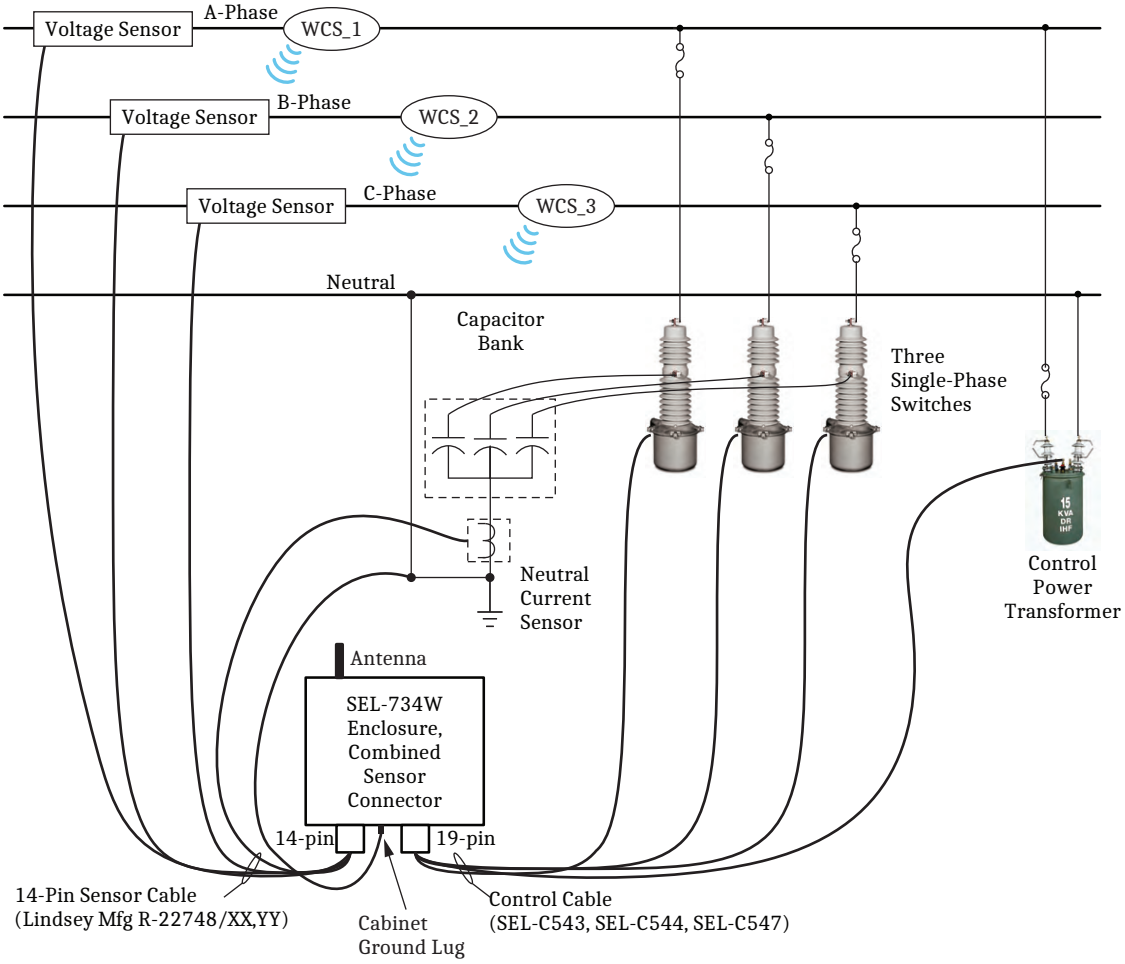

Figure 4.3 Three-Phase Measurements and Single-Pole Switching Application

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SECTION 5

SEL-734W

Overview

The SEL-734W is a capacitor bank controller that controls the operation of capacitor bank switches on three-phase power systems. The SEL-734W comes with a pre-installed template that supports the following automatic control strategies:

Available Control Strategies	Enclosure/Field Interface		
	Full-Size Enclosure	Compact Enclosure	
		4-Jaw Socket	7-Pin (Connectorized and Terminal Block)
Ganged Phase Control	X	X	X
Individual Phase Control	X		
Voltage Control	X	X	X
kVAR Control	X	X	X
Power Factor Control		X	X
Current Control	X	X	X
Temperature/Time Control	X	X	X
Time-Based Control		X	X
Bidirectional kVAR Control			
Bidirectional Voltage Control	X		
Available Features			
Adaptive Voltage and kVAR Processing		X	X
Neutral Unbalance Alarm and Lockout	X		X
Switch Monitoring	X		
Capacitor Fault Detection	X		X
Integrated 15 Vdc Power Supply	X	X	X
Harmonic Lockout		X	X
Overvoltage Lockout	X	X	X
Phase Overcurrent Fault Detection	X		
Hunting Lockout	X	X	X
Hunting Delay (Short-Term Hunting Problems)		X	X
Emergency Voltage Control	X	X	X
Separate Open and Close Delay Timers	X	X	X
Time-Based Control Voltage Offset		X	X

ACSELERATOR QuickSet SEL-5030 Software design templates configure the SEL-734W for capacitor bank control. Design templates are customized software interfaces that allow you to configure the threshold, time-delay, alarms, warning,

and communications settings for capacitor bank control. The enclosure connects to a 120 Vac control power transformer (CPT) and a three-phase capacitor bank switch. The SEL-734W uses LINAM Wireless Current Sensors to measure current quantities. All connections to the primary equipment are made through socket stabs located on the back of the enclosure.

Capacitor Bank Control

This section describes the operations and the functionality provided by the SEL-734W pre-installed template. For more detail, see the *SEL-734W Template Reference Guide*.

Modes of Operations

The controller operates the capacitor switch based on the active mode of operation. The following list gives a brief description of each mode of operation.

MANUAL. Manual mode prevents all automatic and remote control operations and enables control from the front-panel pushbuttons.

AUTO. Auto mode enables automatic operations and prevents control from the front-panel pushbuttons.

SCADA. SCADA mode enables remote control operations and disables automatic operations and control from the front-panel pushbuttons.

QS HMI. QS HMI mode enables remote monitoring and control of capacitor bank operations from QuickSet.

AUTO/SCADA Safety Time. The controller has a safety timer that delays all operations for 15 seconds after the controller enters the AUTO or SCADA mode from the Manual mode. The respective LED flashes while the safety timer is active, during which the controller prevents switch operation, allowing personnel to vacate the area.

Settings

Figure 5.1 shows an SEL-734W. The orange rectangle in the figure indicates the switches where you make the different settings from those on the SEL-734W.

Figure 5.1 SEL-734W

SEL-734W Settings

NOTE: When making control (DIP) switch settings changes, disable automatic control because measurements are poorly defined while transitioning between settings.

The Network ID must match the Network ID setting for the LINAM Wireless Current Sensors used with this SEL-734W. The following sections explain the other settings on the SEL-734W.

Phantom Voltage

Use **SW1** to enable phantom voltages in installations where single-phase ac power is the only voltage brought to the SEL-734W. With phantom voltages, the V1 voltage is copied onto V2 with a –120 degree phase shift and onto V3 with a +120 degree phase shift. Use **SW11**–**SW16** to select the phase being read onto V1. The instantaneous metering values will display primary values for VA, VB, and VC when phantom voltage metering is enabled.

Distance to Sensor

Use the Distance to Sensor setting (**SW2**) to ensure that an SEL-734W does not receive messages from a LINAM WCS on the system that has reused the Network ID of the LINAM WCS associated with the SEL-734W. This happens where there are more SEL-734W enclosures in a limited area than the 16 available Network IDs. Although unlikely, under ideal conditions, an SEL-734W can receive data from a LINAM WCS that is farther than a mile away. This setting reduces the sensitivity of the SEL-734W radio receiver, so it will not receive data from distant LINAM Wireless Current Sensors. For most installations that do not require distance greater than 200 ft, set this setting to low to avoid creating unnecessary radio frequency (RF) noise, which can overdrive the receiver.

Line Current Range

The Line Current Range setting (**SW3**) refers to the maximum current expected to flow in the line during normal (non-fault) conditions. Use it to increase the resolution of the current reported to the SEL-734W. When greater than the 200 A range, the resolution is approximately 0.25 A. For the lower range setting, the resolution is approximately 0.05 A.

RSSI Mode

NOTE: Before entering RSSI mode, disable automatic control and be aware that your device will not report accurate current values while you are in this mode.

When **SW4** is enabled, the SEL-734W changes from reporting line current measurements through the IA, IB, and IC channels to displaying the signal strength. Instead of the physical quantity being the current in amperes, the display shows the signal strength in decibels (dB). This means that the Ia, Ib, and Ic values will be RSSI values. Typically, over-the-air RSSI is a negative numeric value, but the SEL-734W expresses this as a positive value. The SEL-734W receive sensitivity is –85 dBm, and reliable communications require an RSSI of –85 or greater.

RSSI mode is a troubleshooting tool to be used during sensor installation and in the event of sporadic or lost sensor communications. Do not leave the device in RSSI mode with the intention of measuring currents for use in metering or control.

Voltage and Current Phases

Use the remaining control (DIP) switches (**SW5**–**SW16**) to map the voltage and current values to the appropriate phases for use in the SEL-734W. For example, an individual LINAM WCS is not configured natively for A-, B-, or C-Phase. The sensor is configured to Phase 1, 2, or 3, and you are able to use **SW5** and **SW6** to configure whether you want A-Phase to be read from I1, I2, or I3. Similarly with voltage, you can map A-Phase voltage to any of the three voltage measurement inputs on the device.

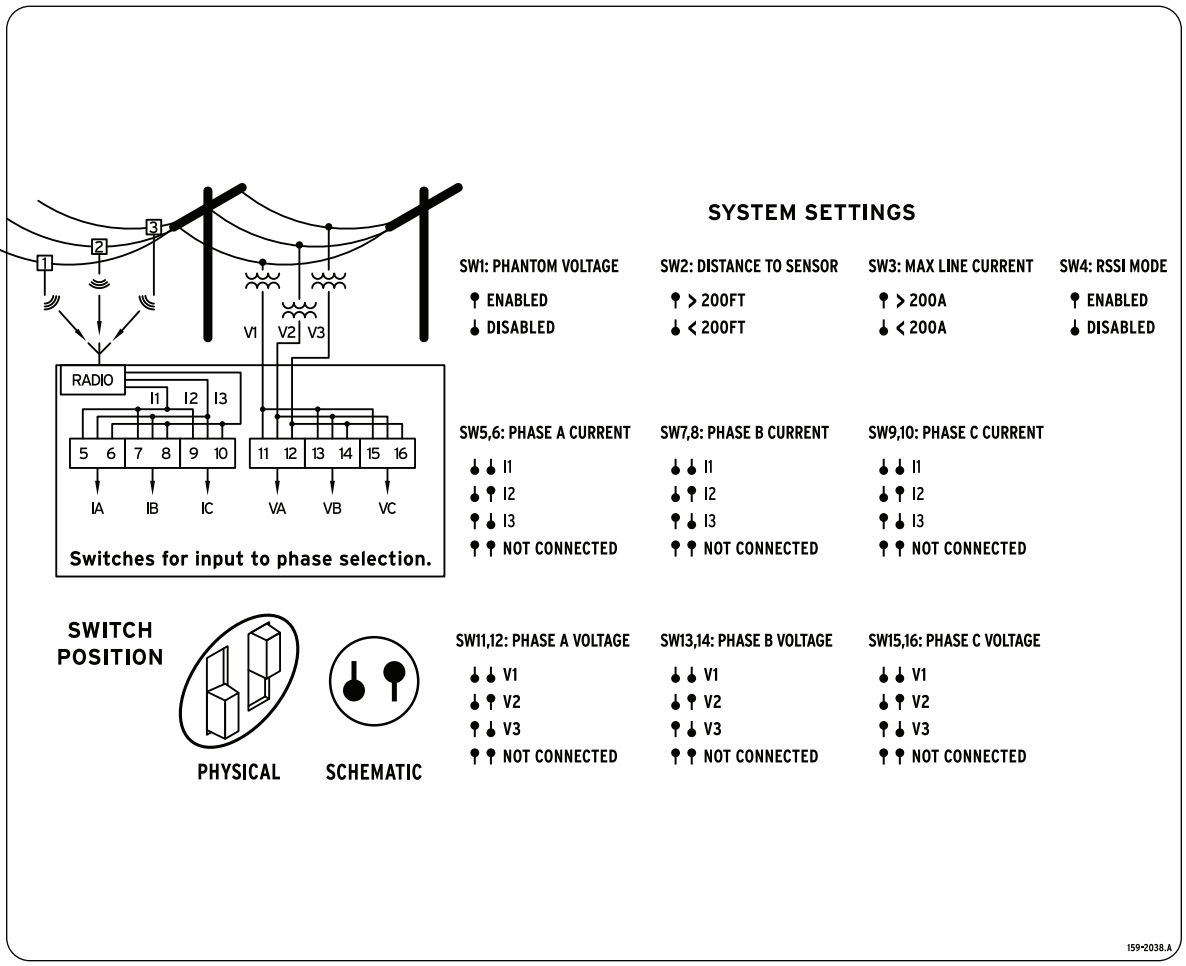

Figure 5.2 SEL-734W Control (DIP) Switch Settings

Table 5.1 Control (DIP) Switch Settings (Sheet 1 of 2)

Setting	Setting Inputs	Range	Default	Description
Phantom Voltage	SW1	Enabled or Disabled	Disabled	Copies the V1 voltage onto V2 with a –120 degree phase shift and onto V3 with a +120 degree phase shift.
Max Distance to Sensor	SW2	>200 ft, <200 ft	<200 ft	Set according to your sensor distance. This setting adjusts the gain on the wireless current sensor receiver.
Max Line Current	SW3	>200 A, <200 A	>200 A	Set according to your maximum line current you expect to be reported.
RSSI Mode	SW4	Enabled or Disabled	Disabled	Changes the currents to report RSSI values for each phase. Used as a troubleshooting tool. This should be used with automatic control disabled.
Phase A Current	SW5, SW6	I1, I2, I3	I1	Sets which wireless current sensor will be mapped to report current on A-Phase.
Phase B Current	SW7, SW8	I1, I2, I3	I2	Sets which wireless current sensor will be mapped to report current on B-Phase.
Phase C Current	SW9, SW10	I1, I2, I3	I3	Sets which wireless current sensor will be mapped to report current on C-Phase.
Phase A Voltage	SW11, SW12	V1, V2, V3	V1	Sets which voltage sensor will be mapped to report voltage on A-Phase.

Table 5.1 Control (DIP) Switch Settings (Sheet 2 of 2)

Setting	Setting Inputs	Range	Default	Description
Phase B Voltage	SW13, SW14	V1, V2, V3	V2	Sets which voltage sensor will be mapped to report voltage on B-Phase.
Phase C Voltage	SW15, SW16	V1, V2, V3	V3	Sets which voltage sensor will be mapped to report voltage on C-Phase.

ENABLED LED

The **ENABLED** LED shown in *Figure 5.3* is solid green when the control (DIP) switches are configured properly (see *Figure 5.2*), flashing when the control (DIP) switches are misconfigured or if the RSSI mode is activated, and off if the wireless current sensor receiver board is in an error state and not executing code. A device defines a misconfiguration condition as a configuration where no voltage is mapped to V1 or a condition where a single electrical input is mapped to more than one metered value.

Receiver USB-C Port

Use the USB-C port labeled **RECEIVER** in *Figure 5.3* for updating firmware on the wireless current sensor receiver board in the field.

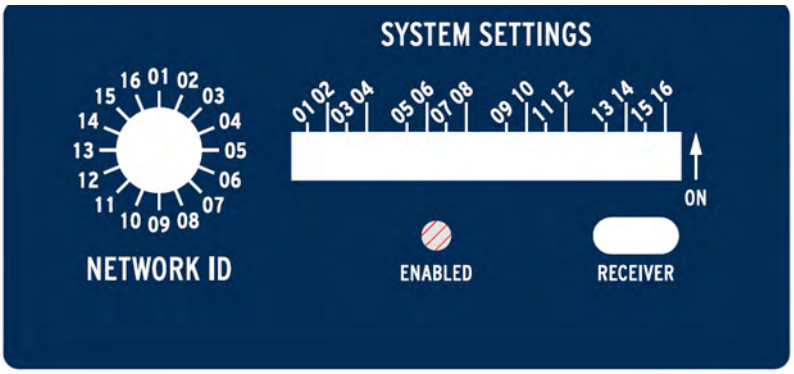

Figure 5.3 SEL-734W Wireless Receiver Panel

Front-Panel Operations

LEDs

Table 5.2 and *Table 5.3* describe the behavior of the six front-panel LEDs. See the explanation of the pushbutton LEDs in *Pushbuttons* on page 5.8.

Table 5.2 Full-Size Enclosure Front-Panel LED Descriptions

LED Label	Message Description
PHASE A CLOSED PHASE B CLOSED PHASE C CLOSED	The three LEDs indicate the status of the three individual capacitor bank switches. If the 52b signal is not present, the LED illuminates to indicate that the switch is closed. If the 52b signal is present, the LED clears to indicate that the switch is open.
WCS ERROR	Illuminates when the SEL-734W has not received an update from the LINAM WCS for 5 minutes. Extinguishes when the SEL-734W starts receiving a current update from the LINAM WCS.
INHIBITED	Illuminates when any inhibited operation condition asserts.
LOCKOUT	Illuminates when any lockout condition is asserted. Flashes during the power-up inhibit time.

Table 5.3 Compact Enclosure Front-Panel LED Descriptions

LED Label	Message Description
CONTROL VOLTAGE	Illuminates when the voltage is within the voltage control band. Flashes when the voltage is outside of the voltage control band. Extinguishes when the voltage falls below the voltage inhibit threshold or rises above the overvoltage trip threshold.
ADAPTED VOLT/VAR	Illuminates when the AVAR processing is active. Refer to the SEL-734W design template guides for further details.
WCS ERROR	Illuminates when the SEL-734W has not received an update from the LINAM WCS for 5 minutes. Extinguishes when the SEL-734W starts receiving a current update from the LINAM WCS.
INHIBITED	Illuminates when any inhibited operation condition asserts.
CAP DISCHARGING	Illuminates while the capacitor bank is discharging.
LOCKOUT	Illuminates when any lockout condition is asserted. Flashes during the power-up inhibit time.

Pushbuttons

The following section explains the operation of the local pushbuttons.

RESET Pushbutton

Activate the Manual mode and hold the **RESET** pushbutton for three seconds to reset the following features:

- Inhibited latch
- Fault latch
- Lockout conditions

Press **RESET** to test all of the front-panel LEDs.

CLOSE and OPEN Pushbuttons

These pushbuttons initiate a local capacitor bank switch operation. The controller delays the operation by the time defined by the Local Close Delay and Local Open Delay settings. Two LEDs next to each pushbutton indicate the status of the switch and pending operations. Each pushbutton has two associated LEDs. Both LEDs indicate the state of the switch. A pending operation is indicated when either the **OPEN COMMAND** LED is flashing and the **OPENED** LED is off, or the **CLOSED COMMAND** LED is flashing and the **CLOSED** LED is off. Both LEDs flashing for the **OPEN** or **CLOSE** pushbutton indicates that the controller is operating the switch and that the **OPEN** or **CLOSE** output contact is asserted. A steady **OPENED** or **CLOSED** LED indicates that the switch is open or closed.

To initiate a local close or local open operation, the controller must be in the Manual mode and the following conditions must be met:

- Manual control mode is active
- Voltage is greater than the voltage inhibit threshold
- The power-up inhibit is not active

For close operations, the following additional conditions must be met:

- Voltage is less than the overvoltage trip threshold
- Harmonics content is less than the high-harmonic trip threshold

If these requirements are not met while the controller is counting down to the operation, the controller will cancel the pending operation. Once you press the **OPEN** or **CLOSE** pushbutton, the controller counts down to the time of the operation. The time delay is 30 seconds by default. You may change the countdown time of the Local Close Delay and Local Open Delay settings anywhere from 5 to 60 seconds. During the countdown, the LCD displays the countdown time and the **OPEN COMMAND** or **CLOSE COMMAND** LED flashes. To cancel the command, press any pushbutton other than the pushbutton of the pending operation.

MANUAL Pushbutton

Press the **MANUAL** pushbutton to deactivate the SCADA and Auto modes and to enable the Manual control mode. See *Control Modes* in the *SEL-734W Template Reference Guide* for a description of the Manual control mode behavior.

AUTO/SCADA Pushbutton

The **AUTO/SCADA** pushbutton activates the AUTO and SCADA modes and deactivates Manual mode. Depending on the state of the SCADA bit, this pushbutton activates either AUTO or SCADA modes. When viewed from the Capacitor Bank Overview page of the QuickSet HMI, this button is preconfigured to enable/disable HMI control mode. See *Control Modes* in the *SEL-734W Capacitor Bank Controller Design Template Guide* for a description of pushbutton behavior.

Power System Quantity Measurements

The SEL-734W uses measured voltage(s) and the current and harmonic quantities from the LINAM WCS to compute power system quantities such as apparent, real, and reactive power; energy; power factor; and harmonic total distortions.

For a single-phase installation (one measured voltage and one measured current sent by the LINAM WCS), the SEL-734W computes single-phase power system quantities and uses these single-phase quantities for metering and switching decisions.

For a three-phase installation, three LINAM Wireless Current Sensors are required. The SEL-734W Compact Enclosure can measure only one phase, so it creates the other two voltage phases of equal magnitude to the measured voltage but at +120 and –120-degree rotation relative to the measured phase (phantom voltages). When phantom voltages are being used, the SEL-734W uses A-Phase for power factor control and uses either one of the phases or the average of the three phases for current control and for kVAR control.

With the Full-Size Enclosure, you can measure as many as three voltages that you can use to enable either ganged operation or individual phase control. Each phase can be independently monitored and switched.

The LINAM WCS transmits current magnitude intermittently. The SEL-734W interprets that data and creates a waveform that is recognized by the SEL-734W as an analog signal. This means that all of your metered currents are reported as a perfect sine wave based on the last received rms value from the LINAM WCS. See *Section 7: Differences Between the SEL-734B and the SEL-734W* for details.

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SECTION 6

LINAM Wireless Current Sensor

Overview

The LINAM WCS provides measurements of power line current, both the fundamental frequency and harmonic frequencies (up to the 15th). This is provided in a package that is easy to mount using a hot stick and requires no wiring to the capacitor bank control or to a power source. Power is harvested from the magnetic field surrounding the power line when current is flowing. The LINAM WCS operates without use of a battery, getting rid of that maintenance concern while allowing for a smaller, simpler device. The LINAM WCS measures the current and updates the SEL-734W periodically, making sure that it has enough stored energy to complete the measurement and transmit the information to the SEL-734W before starting the measurement process. The SEL-734W provides a measurement range of 5 to 1000 A. The LINAM WCS is paired to an SEL-734W by settings selections made on both devices.

Current Measurements

Measurements are made by the sensor and sent to the SEL-734W about once every second or as harvested energy allows, whichever is slower. The SEL-734W will use the last value transmitted in all reporting, calculations, and actions involving the current until the next update of the current. If the SEL-734W has not received a recognizable update within a certain timeframe, the current value is set to zero and stays at zero until the next successful update. A switch-selectable setting for the LINAM WCS tells the sensor whether it should calculate the magnitude and phase values of the harmonics. By selecting the option for no calculation of the harmonics, the sensor will send updates more frequently when line current is below a certain value. *Table 6.1* compares typical update periods with and without harmonics calculation for certain values of line current.

Table 6.1 LINAM WCS Typical Update Period Versus Line Current

Line Current (amperes rms)	No-Harmonics Update Period (seconds)	Harmonics Update Period (seconds)
2	30	80
5	6	15
10	3	8
20	1.3	4
50	1.3	2
100	1.3	1.5

Table 6.1 shows the approximate update rate versus current for certain values of power line current. The update rate is given for two cases: fundamental current measurement or fundamental and harmonic current measurements. The power

consumption by the processor to calculate the magnitude and angle of the harmonic frequencies means a slower update rate of power line current when said line current is below 100 A.

LINAM WCS Settings

Network ID Settings

The LINAM WCS has a 4-bit control (DIP) switch that allows it to configure the Network ID. *Table 6.2* shows the frequency associated with each Network ID. Control (DIP) switches **SW1**–**SW4** shown in *Figure 6.1* are for the Network ID.

Table 6.2 Frequency Channels

Network ID	Frequency (MHz) (U.S.A. and Canada)	Frequency (MHz) (Brazil)
1	906	903
2	907	904
3	908	905
4	909	906
5	910	916
6	911	917
7	912	918
8	913	919
9	914	920
10	915	921
11	916	922
12	917	923
13	918	924
14	919	925
15	920	926
16	921	927

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.

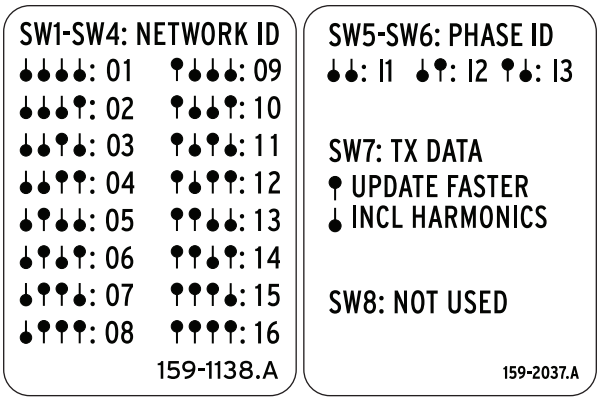

Figure 6.1 Control (DIP) Switch Configurations

Harmonic Content Control (DIP) Switch Setting

Control (DIP) switch **SW7** configures the LINAM WCS, whether it calculates and sends harmonic contents of the current to the SEL-734W.

Phase Identification Settings

The LINAM WCS uses two control (DIP) switches (**SW5** and **SW6**) to configure the phase information. *Table 6.3* shows the phase identification settings.

Table 6.3 Phase Identification Configuration

Switch Settings (SW5, SW6)	Phase
00	I1
01	I2
10	I3
11	Reserved

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SECTION 7

Differences Between the SEL-734B and the SEL-734W

Overview

The SEL-734B receives an analog representation of the current in the power line being monitored. The analog signal is digitized in the SEL-734B. The digitization rate of the SEL-734B is fast enough that the system runs as if it is continuously varying data. The LINAM WCS samples the representation of the power line current at a high rate, but only for the few cycles it requires to determine the state of the current (amplitude and spectral content). The SEL-734W receives the information and repeatedly uses it until a new update is received. The SEL-734W supports all the same functions of the SEL-734B, such as metering, power quality and event analysis, waveform capture, Sequence of Events (SOE) reporting, and capacitor bank control operation. The degree to which each of these functions is impacted is determined by how often the function updates relative to the update rate from the LINAM WCS and how much the current changes between sensor updates. Each of these functions is described in this section.

Capacitor Bank Control Strategies

The SEL-734B provides different capacitor bank control strategies and switching options depending on its hardware options. See the *SEL-734B Field Application Guide* and *Template Guides* for details. The template guides specify the list of control strategies that are available for each hardware option. *Table 7.1* compares the control strategies between the SEL-734B and SEL-734W.

Table 7.1 SEL-734W and SEL-734B Control Strategy Comparison (Sheet 1 of 2)

Available Control Strategies	SEL-734W			SEL-734B				
	Full-Size Enclosure	Compact Enclosure		Full-Size Enclosure	Compact Enclosure			
		4-Jaw	7-Pin		4-Jaw	6-Jaw Option A	6-Jaw Option B	7-Pin
Voltage Control	X	X	X	X	X	X	X	X
kVAR Control	X	X	X	X		X	X	X
Power Factor Control		X	X			X	X	X
Current Control	X	X	X			X	X	X
Time/Temp-Based Control	X	X	X	X	X	X	X	X
Ganged Phase Control	X	X	X	X	X	X	X	X
Individual Phase Control	X			X				

Table 7.1 SEL-734W and SEL-734B Control Strategy Comparison (Sheet 2 of 2)

Available Control Strategies	SEL-734W			SEL-734B				
	Full-Size Enclosure	Compact Enclosure		Full-Size Enclosure	Compact Enclosure			
		4-Jaw	7-Pin		4-Jaw	6-Jaw Option A	6-Jaw Option B	7-Pin
Bidirectional kVAR Control		X				X		X
Bidirectional Voltage Control	X	X				X		X

Metering

Both the SEL-734B and SEL-734W use the same calculation method to compute metering quantities. The quantities include instantaneous, demand, energy, maximum and minimum, crest factor, and harmonics. The metering data provided by both the SEL-734B and SEL-734W can be different whenever the SEL-734W has an update and the current has changed since the last update. The SEL-734B can capture more transient behavior than the SEL-734W. For a smooth load current, it is expected that both the SEL-734B and SEL-734W have similar metering quantities.

Power Quality and Event Analysis

Because of the metering data differences between the SEL-734B and SEL-734W, the power quality given by them are different. SEL does not recommend that the SEL-734W be used as a revenue meter or a device that you expect to capture quick changes or transients.

Both the SEL-734B and SEL-734W use the same methods and techniques to generate event reports. The reports include waveform capture event reports, Sequential Event Recorder (SER) reports, and voltage sag/swell/interruption (VSSI) reports. See *Section 6* in the *SEL-734 Instruction Manual* for details.

Waveform Capture Event Reports

Waveform capture, also known as oscillography, allows the SEL-734W to record the voltage and current waveforms associated with programmable trigger conditions, such as a voltage interruption. The sample rate and duration of the waveform capture are predetermined by using Event Report settings. The supported sample rate is 1 kHz. The 1 kHz sample rate contains harmonic content as far as the 7th order.

The duration of the waveform capture can be set to 0.25 seconds or 15 cycles for a 60 Hz system. Each waveform capture contains at least 4 cycles of pretriggered data.

Although the SEL-734W can capture waveforms for 0.25 seconds, the measured current waveform will likely remain constant during this interval because of the SEL-734W update rates. It is possible to see a jump in the captured current waveforms if the LINAM WCS provides an update of the current values during this 0.25 second interval.

Sequence of Events (SOE) Report

Users program conditions (known as trigger settings) under which values are logged to the Sequence of Events (SOE) report. If the line current is used as part of a trigger setting, the trigger may be delayed based on when the LINAM WCS update is received. If a transient in the current does not last long enough to be captured by the LINAM WCS, no event capture will happen. For an event capture that is triggered, the line current reported may not be the line current at the time of the event. Keep these differences in mind when using the SEL-734W SER reports for forensic analysis.

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SECTION 8

Testing and Troubleshooting

Table 8.1 provides instructions for troubleshooting and common problems.

Table 8.1 Troubleshooting and Common Problems

Problem	Solution
CLOSE or **OPEN** Button Does Not Respond	➤ Check that the Manual mode is enabled. Press the **MANUAL** pushbutton to enable this mode. ➤ Check that the control power is healthy: ➢ Check that the control power fuse located on the inside of the enclosure has continuity. ➢ Check that 120 Vac is present. Refer to the enclosure wiring and check that 120 Vac voltage is present between the control power fuse and neutral. ➢ Check the front panel. Refer to the appropriate design template guide to check the SEL-734W indicators of control power. ➤ Check that an overvoltage does not exist. To protect the switches and the capacitor bank, the controller will not close a switch if an overvoltage condition exists. Refer to *SEL-734W Template Reference Guide* to check the SEL-734W lockout indicators.
LINAM WCS Communications Dropout	➤ Check that the position of the switch for setting short or long distance for the sensor is set correctly. ➤ Check that the sensors are visible from the antenna of the SEL-734W (line-of-sight). ➤ Check for interference from other wireless devices and try other network IDs. ➤ Check the line currents are higher than 2 A minimum for LINAM WCS energy harvesting. ➤ Check the signal strength by enabling RSSI mode and monitoring signal strength: ➢ Try repositioning the LINAM WCS to a position further away or closer to the SEL-734W. ➢ Try rotating the SEL-734W to a different position on the pole relative to the power lines.

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APPENDIX A

Firmware and Field Reference Guide Versions

Firmware

The SEL-734W Capacitor Bank Control and the LINAM Wireless Current Sensors (WCS) have three different sets of firmware at a given time. The SEL-734 itself has firmware that controls the device. To see these firmware revisions and instructions on upgrading the meter firmware, refer to the SEL-734 instruction manual.

In addition to the meter firmware, the SEL-734W has an additional firmware file that is used to govern the receiver functionality, namely any functionality directly related to receiving signals from the LINAM WCS.

The LINAM WCS has its own unique firmware file. This firmware is also not upgradeable in the field.

Determining the Firmware Version

To determine the firmware version for the LINAM WCS, refer to the serial number on the devices.

To determine the firmware version of your SEL-734, connect to the PORT F serial port and issue the **STA** command. The status report displays the Firmware Identification (FID) label.

The wireless receiver has one released firmware version for units shipped to the U.S.A. and Canada and one for units shipped to Brazil.

The firmware version number is after the R, and the release date is after the D. For example, the following is firmware version number R101, release date January 19, 2023.

FID=SEL-WCSR-R101-V1-Z001001-D20230119

For firmware versions of your wireless sensor receiver board prior to date code 20230119, refer to the serial number on the devices.

Revision History

Table A.1 and *Table A.2* list the firmware versions, revision descriptions, and corresponding instruction manual date codes for the SEL-734W, LINAM WCS, and wireless sensor receiver board. The most recent firmware version is listed first.

Starting with revisions published after March 1, 2022, changes that address security vulnerabilities are marked with "[Cybersecurity]". Improvements to cybersecurity functionality that should be evaluated for potential cybersecurity importance are marked with "[Cybersecurity Enhancement]".

Table A.1 Wireless Sensor Receiver Board Firmware Revision History

Firmware Identification (FID) Number	Summary of Revisions	Serial Number	Manual Date Code
SEL-WCSR-R101-V1-Z001001-D20230119	➤ Contains all functionality built in R101-V0. ➤ Implemented automatic reset of radio chip following a power cycle.	~3230100001	20231206
SEL-WCSR-R101-V0	This firmware did not production release. ➤ Added support of control (DIP) switch settings that assign the LINAM WCS and voltage input phases. ➤ Added support of phantom voltage to mimic phase shifted voltage of V1 onto V2 and V3. ➤ Added RSSI mode to show the signal strength of the wireless communications. ➤ Added command line interface to query the wireless sensor receiver board FID and perform firmware upgrade. ➤ Added firmware upgrade capability.	—	—
SEL-WCSR-R500-V0-Z001001-D20230320	➤ Initial release of Brazil-specific version.	—	20230323
SEL-734-R100-V3-Z33-D20200929	➤ Adjusted clock oscillation rates.	~3202930001	20200929
SEL-734-R100-V2-Z27-D20200320	➤ Initial version.	—	20200929

Table A.2 LINAM WCS Firmware Revision History

Firmware Identification (FID) Number	Summary of Revisions	Serial Number	Manual Date Code
SEL-8340-R500-V0-D20230320	➤ Initial release of Brazil-specific version.	—	20230323
SEL-8340-R100-V3-Z32-D20200916	➤ Added watchdog reset.	~1202930001	20200929
SEL-8340-R100-V2-Z31-D20200320	➤ Initial version.	—	20200929

Field Reference Guide

The date code at the bottom of each page of this field reference guide reflects the creation or revision date.

Table A.3 lists the field reference guide versions and revision descriptions. The most recent field reference guide version is listed first.

Table A.3 Field Reference Guide Revision History (Sheet 1 of 3)

Date Code	Summary of Revisions
20231206	Section 1 ➤ Updated *Overview*, *System Features and Benefits*, *SEL-734W Overview*, and *Specifications*. Section 2 ➤ Added *Connections to the Full-Size Enclosure*. Section 3 ➤ Added *Pole-Mounting the Full-Size and Compact 7-Pin Enclosures*.

Table A.3 Field Reference Guide Revision History (Sheet 2 of 3)

Date Code	Summary of Revisions
	Section 4 ➤ Updated *Figure 4.1: Single-Phase Application* and *Figure 4.2: Three-Phase Application*. ➤ Added *Three-Phase Measurements and Single-Pole Switching*. **Section 5** ➤ Added table to *Overview* to replace bulleted list of features. ➤ Updated *Figure 5.1: SEL-734W*. ➤ Added *RSSI Mode, Compact Enclosure, Full-Size Enclosure, ENABLED LED*, and *Receiver USB-C Port*. ➤ Updated *Table 5.2: Front-Panel LED Descriptions*. ➤ Updated *Power System Quantity Measurements*. **Section 6** ➤ Updated *Figure 6.1: Control (DIP) Switch Configurations*. ➤ Updated *Table 6.3: Phase Identification Configuration*. **Section 7** ➤ Updated *Table 7.1: SEL-734W and SEL-734B Control Strategy Comparison*. **Section 8** ➤ Added LINAM WCS Communications Dropout row to *Table 8.1: Troubleshooting and Common Problems*. **Appendix A** ➤ Updated for firmware versions R101-V1 for the wireless sensor receiver board. **Appendix B** ➤ Added new appendix, *Appendix B: Firmware Upgrade Instructions*. **Appendix C** ➤ Added new appendix, *Appendix C: Installation Examples*. **Appendix D** ➤ Added *Control and Sensor Cables for Full-Size Enclosures*. **Appendix E** ➤ Added *Full-Size Enclosure*. **Appendix F** ➤ Added *Full-Size Enclosure Accessories*.
20230428	**General** ➤ Updated manual throughout for the LINAM WCS references. **Section 1** ➤ Updated *Operating Temperature* in *LINAM WCS Specifications*.
20230323	**Section 1** ➤ Added Brazil-specific frequencies to *Frequency Band* in *SEL-WCS Specifications*. ➤ Added Brazil to *Table 5: Certifications by Country*. **Section 6** ➤ Added Brazil-specific frequencies to *Table 6.2: Frequency Channels*. **Appendix A** ➤ Updated for Wireless Sensor Receiver Board firmware version R500-V0. ➤ Updated for SEL-WCS firmware version R500-V0.
20210527	**Section 2** ➤ Added *Field Connections to the Enclosure*. **Section 3** ➤ New section. **Section 6** ➤ Updated *Table 6.1: SEL-734W and SEL-734B Control Strategy Comparison*.

Table A.3 Field Reference Guide Revision History (Sheet 3 of 3)

Date Code	Summary of Revisions
	Appendix B ➤ New appendix. Appendix C ➤ New appendix. Appendix D ➤ New appendix.
20200929	Appendix A ➤ Added *Firmware*.
20200709	Section 2 ➤ Added *Using the QuickSet HMI*. ➤ Added *Close and Open the Capacitor Bank From QuickSet*. Section 4 ➤ Added QS HMI to *Modes of Operations*.
20200313	➤ Initial version.

APPENDIX B

Firmware Upgrade Instructions

Overview

SEL occasionally offers firmware upgrades to improve the performance of your SEL-734W and your wireless current sensor receiver board. Because firmware is stored in Flash memory, changing physical components is not necessary.

Upgrade the receiver board firmware through the wireless current sensor receiver panel USB-C port. These instructions are for upgrading the wireless current sensor receiver board. The instructions for upgrading the SEL-734 are similar, except that the upgrade is done through the front **PORT F** serial port. Refer to the SEL-734 instruction manual for instructions on upgrading the firmware on the meter. To receive the latest firmware for your SEL product, contact your SEL sales representative or customer service representative.

Upgrade Instructions

Required Equipment

NOTE: The **FID** command shows the firmware ID (FID) and boot firmware ID (BFID).

Gather the following equipment before starting this firmware upgrade:

- Personal computer (PC)
- Terminal emulation software that supports Xmodem/CRC or 1k Xmodem/CRC protocol
- Standard USB-C communications cable
- SEL-C662 USB Cable for Computer Terminal (USB, DB9 M/USB A-Type M, Pin 1 Power)
- Firmware file (e.g., WCSR-R101-V0.bin) saved to an easily accessible location on the PC.

Upgrade Procedure

The following instructions below assume you have a working knowledge of your personal computer terminal emulation software. In particular, you must be able to modify your serial communications parameters (data rate, data bits, parity, etc.), select transfer protocol (Xmodem/CRC or 1k Xmodem/CRC), and transfer files (e.g., send and receive binary files).

Step 1. If the capacitor bank control is in service, follow your company's policy to remove the control from service.

Step 2. Connect the PC to the wireless current sensor receiver panel USB-C port.

Step 3. Start the firmware upgrade.

a. Issue the **L_D** command to the wireless current sensor receiver board.

b. Type **Y <Enter>** at the following prompt:
```
Disable wireless receiver to send or receive firmware (Y,N)?
```

c. Type Y **<Enter>** at the following prompt:
```
Are you sure (Y,N)?
```

The control will send the `!>` prompt.

Step 4. Begin the transfer of new firmware to the control by issuing the **REC** command.

Step 5. Type **Y** to erase the existing firmware or press **<Enter>** to abort.

Step 6. Press any key (e.g., **<Enter>**) when the control sends a prompt.

Step 7. Start the file transfer.

a. Select the send file option in your communications software.

b. Use the Xmodem or 1k Xmodem protocol and send the file that contains the new firmware (e.g., WCSR-R101-V0.bin).

The file transfer takes approximately 1 min at 9600 bps and with 1k Xmodem transfer protocol. After the transfer is complete, the wireless current sensor receiver will respond with the following:
```
Operation completed successfully. Attempting a restart of the wireless receiver.
```

Step 8. Re-establish communications between the SEL-734 and the wireless current sensor receiver following the firmware upgrade.

a. Connect the PC to the SEL-734 **PORT F** front serial port by using an SEL-C662 cable.

b. Issue a **STA C** command on the SEL-734 to clear alarm and re-establish communications with the wireless current sensor receiver, or remove the USB-C connection and restart the device either by removing the power source or pulling the fuse on the main power source.

If you notice any problems or if the wireless current sensor receiver responds with an error such as `Upload failed: Downgrade not allowed`, contact the SEL factory or your Technical Service Center.

The wireless sensor receiver board is now ready for wireless communication.

APPENDIX C

Installation Examples

Full-Size Enclosure

Figure C.1 shows a diagram of a typical installation of the Full-Size Enclosure model with the combined sensor connector.

Ground Conductor

Ground the SEL-734W cabinet by using the ground lug before making any other connections to the cabinet.

Sensor Cable

The sensor cable connects to the 14-pin connector on the bottom of the enclosure. Three measurement legs connect to three combination sensors to measure voltage and current on each phase.

Control Cable

The control cable connects to the 19-pin connector on the bottom of the enclosure. One leg of the cable connects to the control power transformer (CPT), which powers the SEL-734W and provides the operating power to the switches. Each of the other three legs connects to a capacitor bank switch.

The SEL-C543 cable connects to three 5-pin switches and the CPT, and it supports 52b auxiliary contact monitoring. The SEL-C544 cable is similar to the SEL-C543 cable, but it connects to 6-pin switches and supports 52a and 52b auxiliary contact monitoring. The SEL-C547 cable is similar to the SEL-C544 cable, but it connects to 7-pin switches. *Figure C.1* shows an installation using these cables.

Alternatively, the SEL-734W may be connected to the switches through a Cooper CCR116K1 junction box. An SEL-C556 cable connects the SEL-734W to the junction box, and SEL-C526 cables connect each switch to the junction box (as shown in *Figure C.2*). SEL does not offer a cable to connect the CCR116K1 junction box to the CPT.

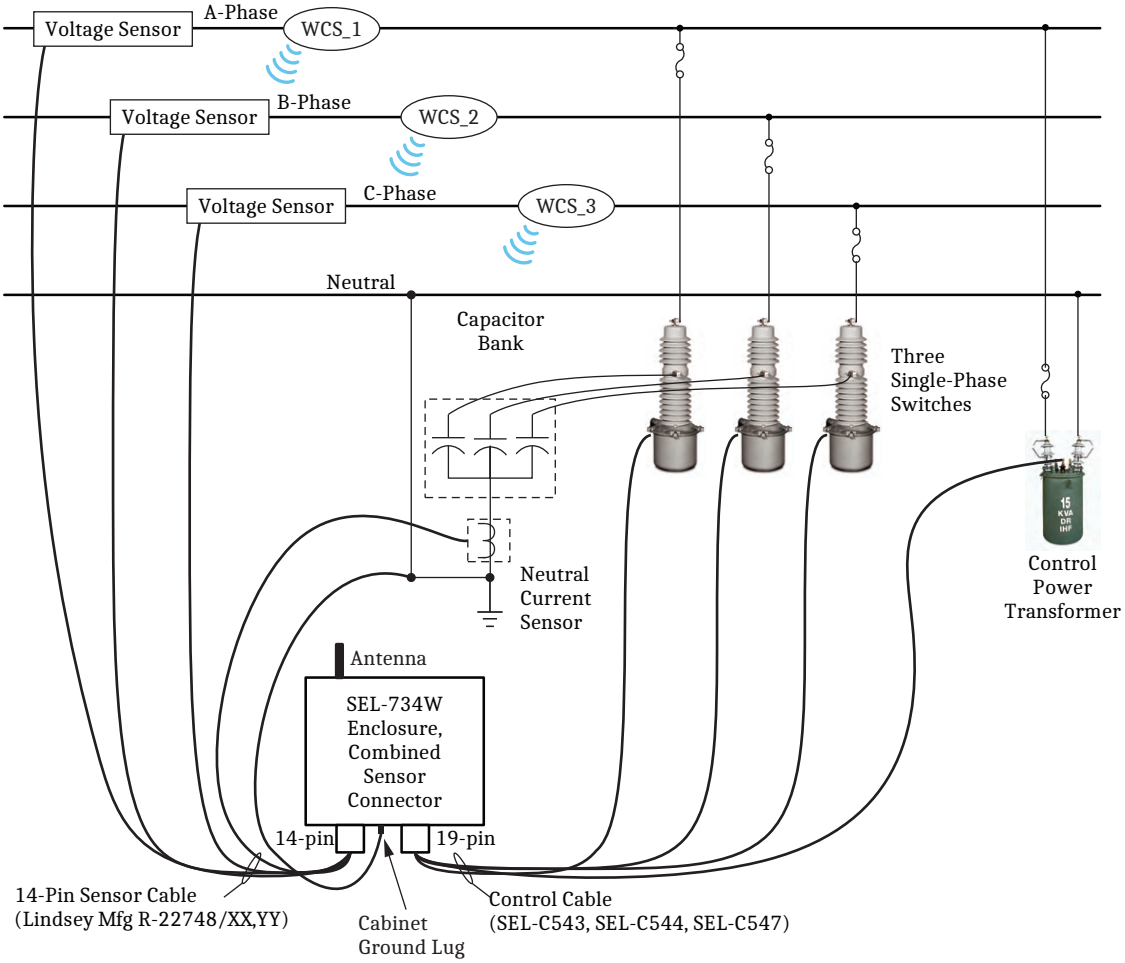
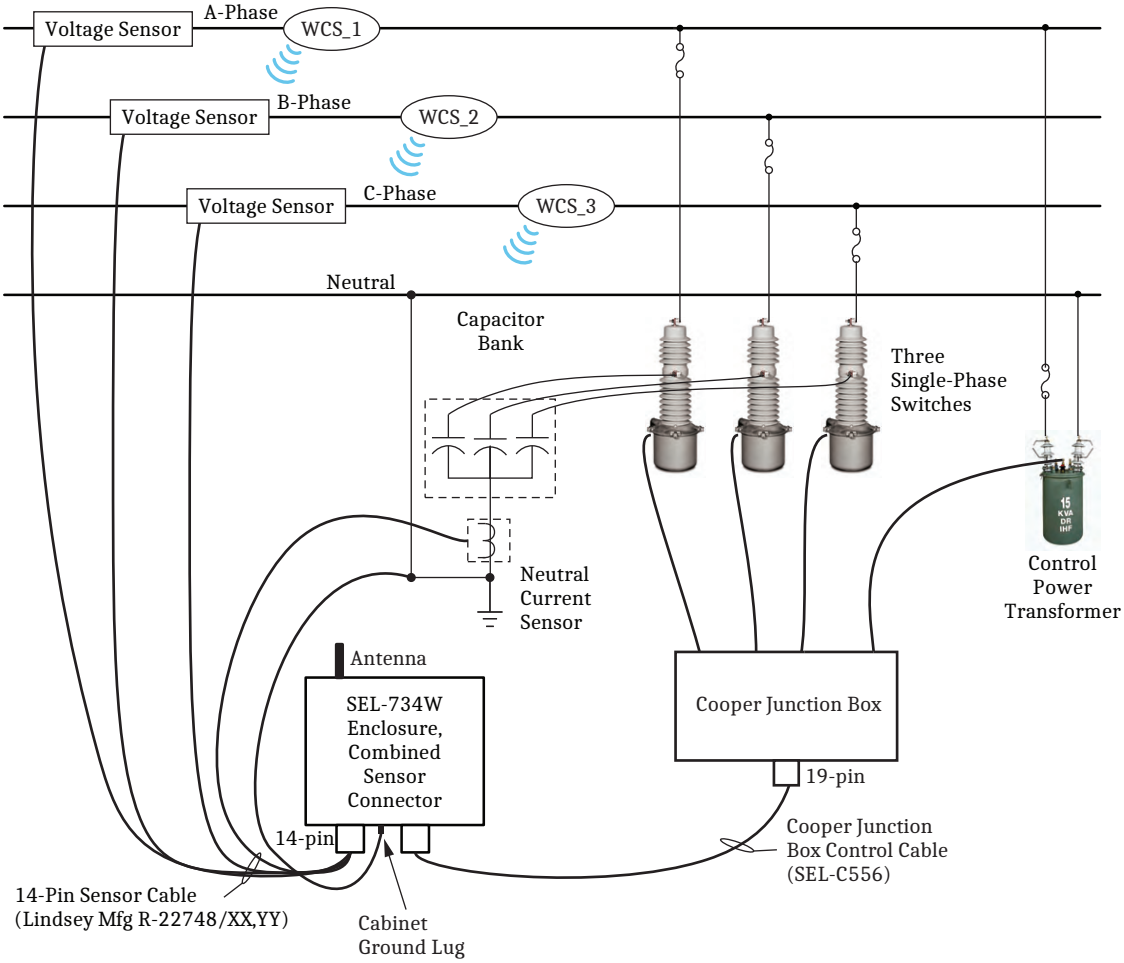
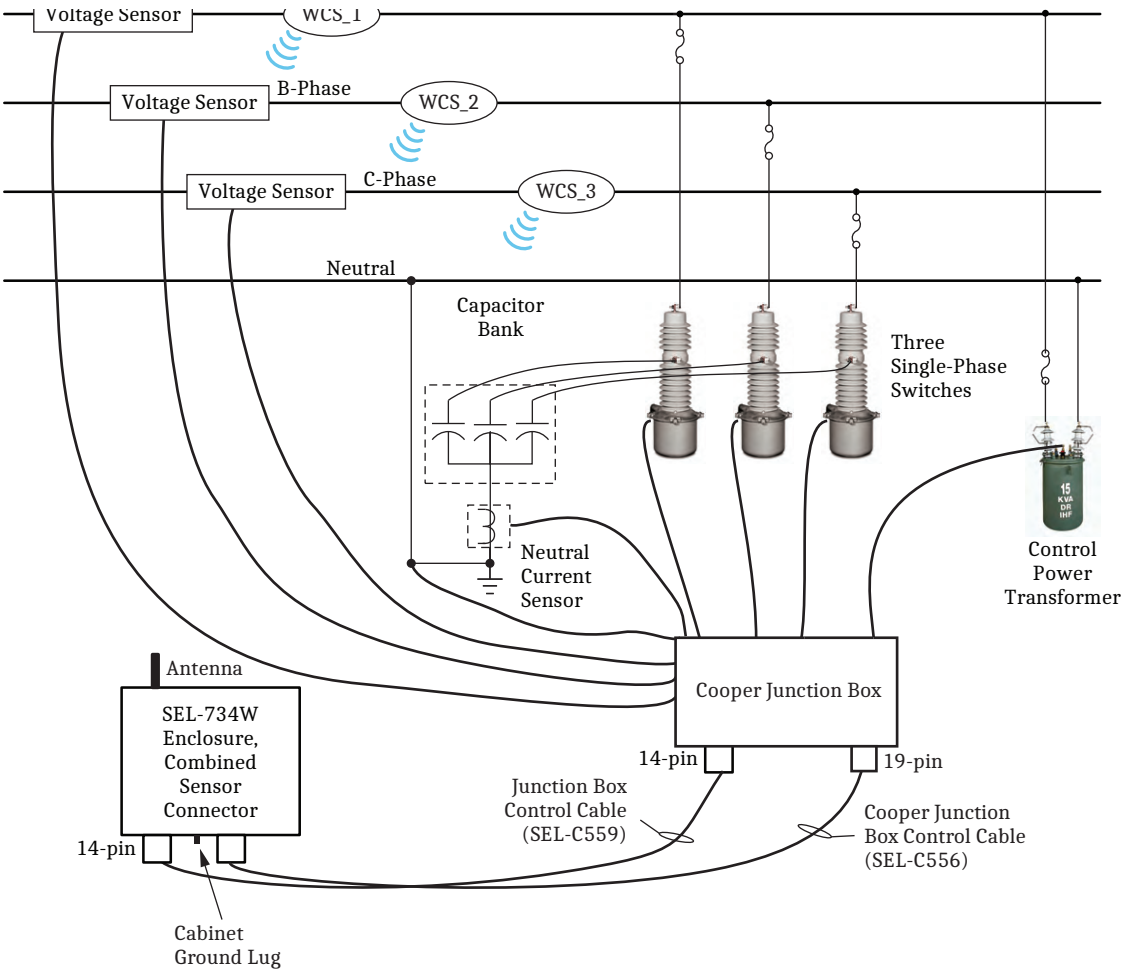


Figure C.1 Full-Size Enclosure With Combined Sensor Connector (With a Single Cable for Phase and Neutral Sensors)



The Full-Size SEL-734W is not wired to use control power voltage for voltage measurement. If you would like to measure Phase A voltage from a CPT, you can make that connection in your junction box as seen in *Figure C.3*.

Figure C.2 Full-Size Enclosure With Combined Sensor With Junction Box (With a Single Cable for Phase and Neutral Sensors)



The Full-Size SEL-734W is not wired to use control power voltage for voltage measurement. If you would like to measure Phase A voltage from a CPT, you can make that connection in your junction box as seen in *Figure C.3*.

Figure C.3 Full-Size Enclosure With Combined Sensor With Junction Box for Sensing and Control

Compact Enclosures

Compact 7-Pin Enclosures

Figure C.4 shows a diagram of a typical installation of the Compact 7-Pin Enclosure. Ground the SEL-734W cabinet before making any other connections to the cabinet.

For a Connectorized enclosure, the SEL-C558 cable connects to a 120 Vac CPT, a three-phase capacitor bank switch, one contact input, and one neutral current sensor. A 7-pin circular connector mates with the enclosure, and a weather-tight seal mounts to a penetration on the junction box.

For a 7-position terminal block enclosure, use a passthrough cable to wire directly to the terminal block in the SEL-734W without a connector. Similar to the Connectorized version, connect the other end to a 120 Vac CPT, a three-phase capacitor switch, contact switch, and a neutral current sensor. The SEL-734W measures the output voltage of the control power transfer and uses the signal for capacitor bank control.

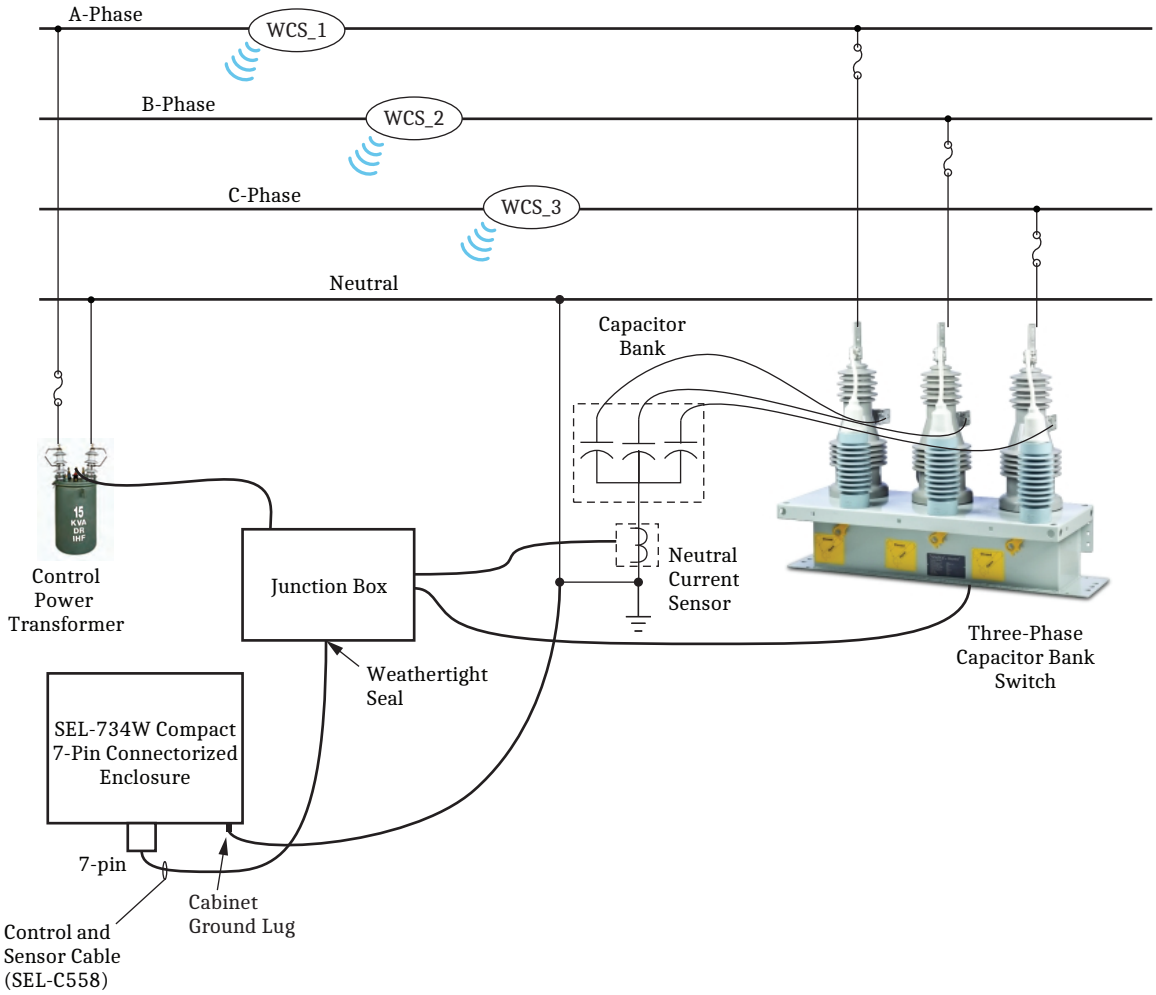


Figure C.4 Compact 7-Pin Connectorized Enclosure

Compact Socket-Based Enclosure

Figure C.5 shows a diagram of a typical installation of the Compact 4-Jaw Enclosure. This installation is similar to the Compact 7-Pin Enclosure, except that all field connections are made through a socket instead of a cable and junction box and there is no provision for a neutral sensor.

Ground the SEL-734W cabinet before making any other connections to the cabinet.

The enclosure plugs into the meter socket base, which provides all of the connections to the field devices. SEL does not provide the cabling to connect the field devices to the meter socket base.

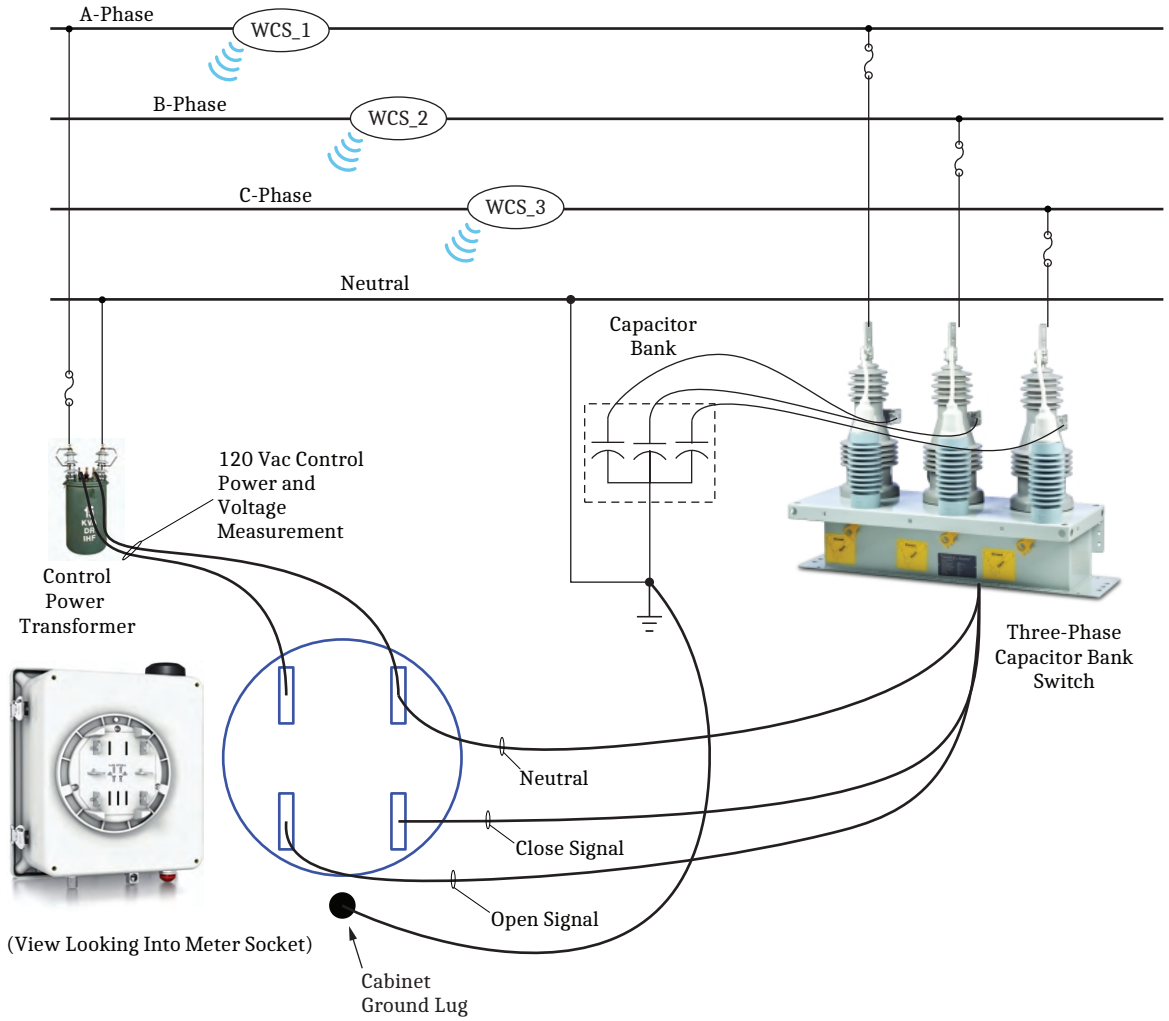


Figure C.5 Compact 4-Jaw Socket-Based Enclosure Connection Diagram

APPENDIX D

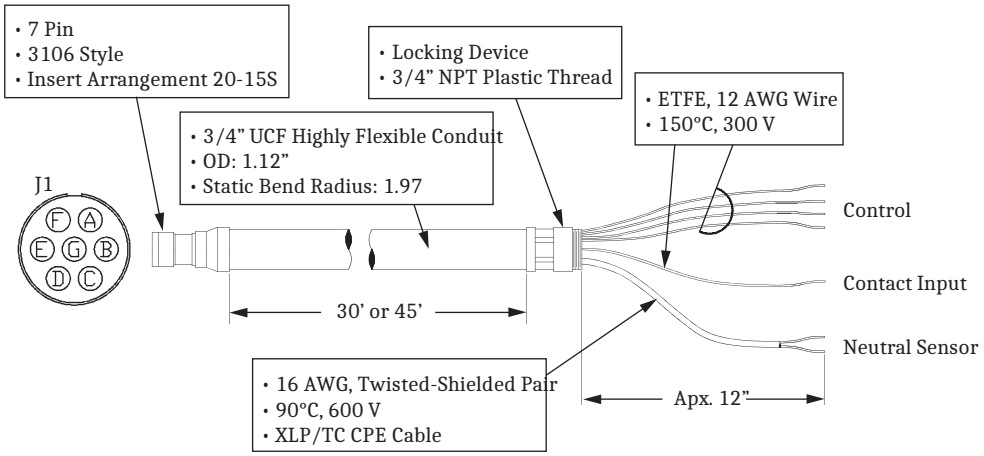
Cable Drawings

This appendix includes the cable drawing for 7-pin Connectorized enclosures.

Control and Sensor Cable for 7-Pin Connectorized Enclosures

SEL-C558

The SEL-C558 cable connects to one neutral sensor, the control power transformer, a contact input, and a three-pole switch. It is available in lengths of 30 ft (9.1 m) and 45 ft (13.7 m).

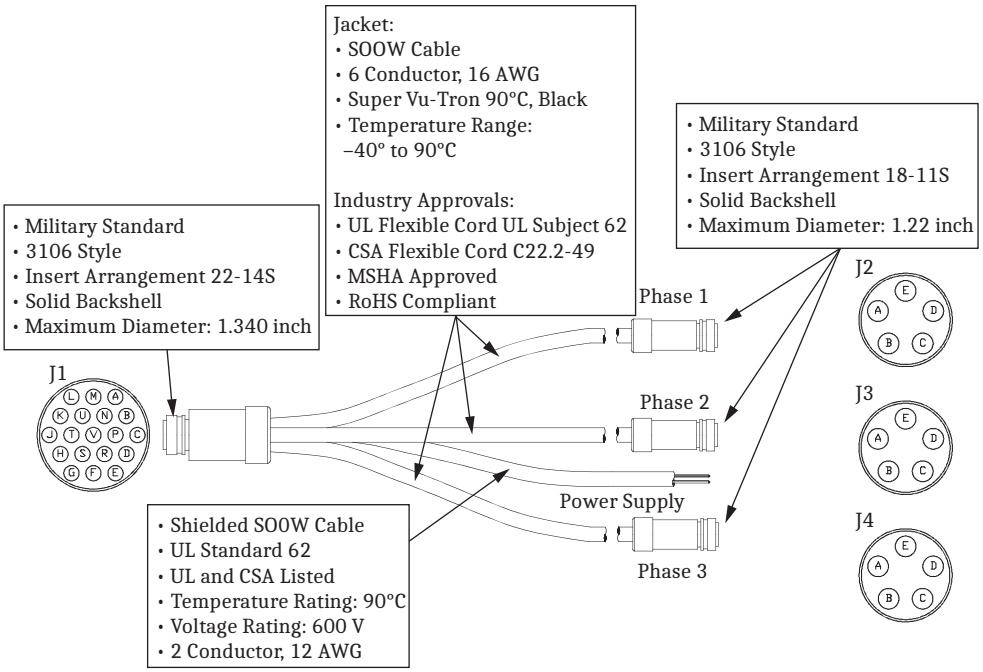


Connector Pin	Function	Conductor Color	Label	
J1-A	120 Vac	Red	120 Vac	Control
J1-B	Open	Green	Open	
J1-C	Close	Black	Close	
J1-G	System Neutral	White	Neutral	
J1-E	Neutral Sensor Polarity	Black	N.C. Pol	Neutral Sensor
J1-G	Neutral Sensor Common	White	N.C. Ret	
J1-G	Drain/Shield	Drain		
J1-D	Input	Red	Contact Input (120V)	

Control and Sensor Cables for Full-Size Enclosures

SEL-C543

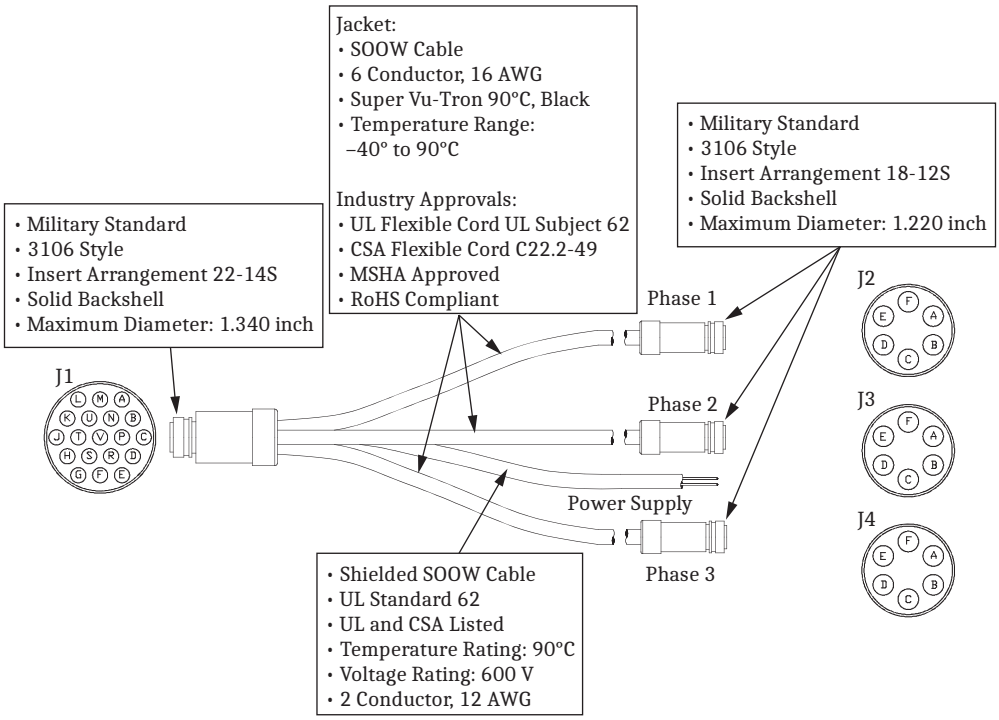
The SEL-C543 cable connects to three switches and the control power transformer (5-pin female connectors).



Connector Pin	Wire Color	Wire Type	Function		Connector Pin
J1-A	Black	#12 AWG 65/30 Strand	Power Supply	120 VAC	Wire Termination
J1-B	White	#12 AWG 65/30 Strand		Neutral	Wire Termination
J1-U	Red	#16 AWG 26/30 Strand	Phase 1	Common	J2-A
J1-E	White	#16 AWG 26/30 Strand		Common	J2-B
J1-D	Green	#16 AWG 26/30 Strand		Close	J2-C
J1-C	Black	#16 AWG 26/30 Strand		Open	J2-D
J1-N	Orange	#16 AWG 26/30 Strand		52b	J2-E
J1-U	Red	#16 AWG 26/30 Strand	Phase 2	Common	J3-A
J1-H	White	#16 AWG 26/30 Strand		Common	J3-B
J1-G	Green	#16 AWG 26/30 Strand		Close	J3-C
J1-F	Black	#16 AWG 26/30 Strand		Open	J3-D
J1-R	Orange	#16 AWG 26/30 Strand		52b	J3-E
J1-U	Red	#16 AWG 26/30 Strand	Phase 3	Common	J4-A
J1-L	White	#16 AWG 26/30 Strand		Common	J4-B
J1-K	Green	#16 AWG 26/30 Strand		Close	J4-C
J1-J	Black	#16 AWG 26/30 Strand		Open	J4-D
J1-T	Orange	#16 AWG 26/30 Strand		52b	J4-E

SEL-C544

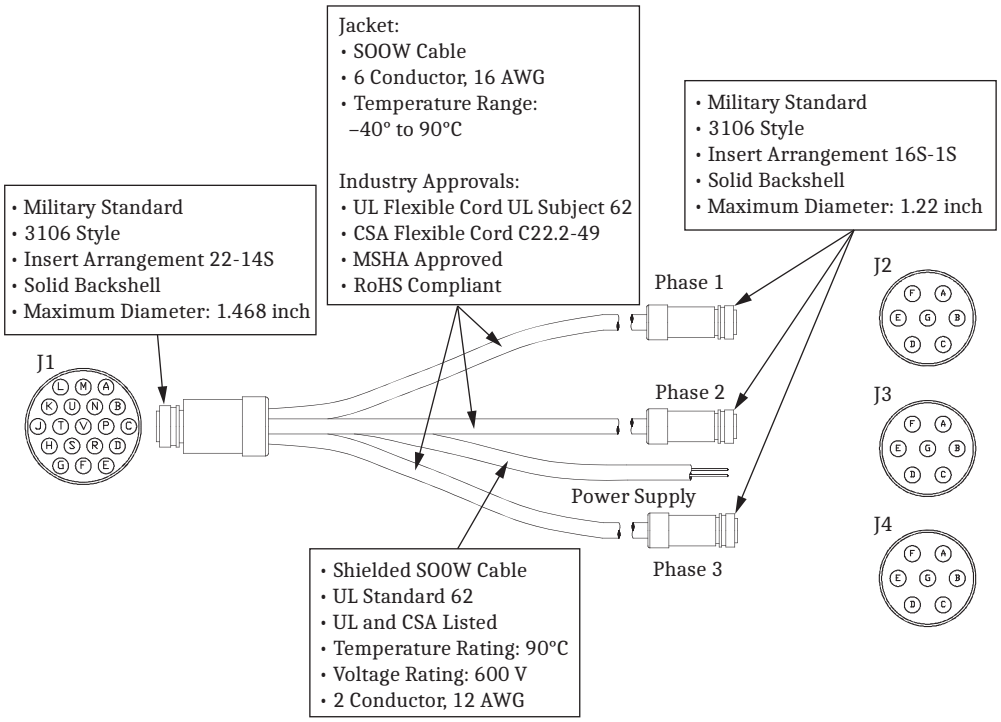
The SEL-C544 cable connects to three switches and the control power transformer (6-pin female connectors).



Connector Pin	Wire Color	Wire Type	Function		Connector Pin
J1-A	Black	#12 AWG 65/30 Strand	Power Supply	120 VAC	Wire Termination
J1-B	White	#12 AWG 65/30 Strand		Neutral	Wire Termination
J1-U	Red	#16 AWG 26/30 Strand	Phase 1	Common	J2-A
J1-E	White	#16 AWG 26/30 Strand		Common	J2-B
J1-D	Green	#16 AWG 26/30 Strand		Close	J2-C
J1-C	Black	#16 AWG 26/30 Strand		Open	J2-D
J1-N	Orange	#16 AWG 26/30 Strand		52b	J2-E
J1-M	Blue	#16 AWG 26/30 Strand		52a	J2-F
J1-U	Red	#16 AWG 26/30 Strand	Phase 2	Common	J3-A
J1-H	White	#16 AWG 26/30 Strand		Common	J3-B
J1-G	Green	#16 AWG 26/30 Strand		Close	J3-C
J1-F	Black	#16 AWG 26/30 Strand		Open	J3-D
J1-R	Orange	#16 AWG 26/30 Strand		52b	J3-E
J1-P	Blue	#16 AWG 26/30 Strand		52a	J3-F
J1-U	Red	#16 AWG 26/30 Strand	Phase 3	Common	J4-A
J1-L	White	#16 AWG 26/30 Strand		Common	J4-B
J1-K	Green	#16 AWG 26/30 Strand		Close	J4-C
J1-J	Black	#16 AWG 26/30 Strand		Open	J4-D
J1-T	Orange	#16 AWG 26/30 Strand		52b	J4-E
J1-S	Blue	#16 AWG 26/30 Strand		52a	J4-F

SEL-C547

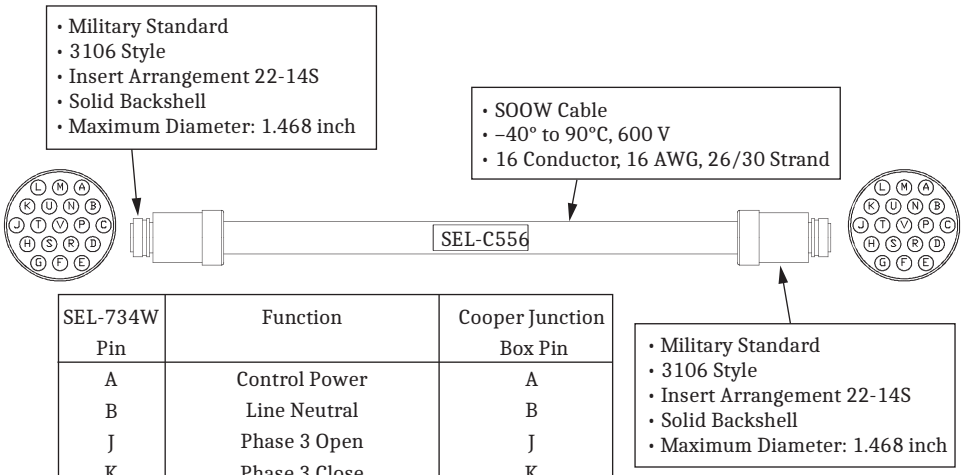
The SEL-C547 cable connects to three switches and the control power transformer (7-pin female connectors).



Connector Pin	Wire Color	Wire Type	Function		Connector Pin
J1-A	Black	#12 AWG 65/30 Strand	Power Supply	120 VAC	Wire Termination
J1-B	White	#12 AWG 65/30 Strand		Neutral	Wire Termination
J1-E	White	#16 AWG 26/30 Strand	Phase 1	Common	J2-B
J1-D	Green	#16 AWG 26/30 Strand		Close	J2-C
J1-C	Black	#16 AWG 26/30 Strand		Open	J2-D
J1-U	Red	#16 AWG 26/30 Strand		Common	J2-E
J1-N	Orange	#16 AWG 26/30 Strand		52b	J2-F
J1-M	Blue	#16 AWG 26/30 Strand		52a	J2-G
J1-H	White	#16 AWG 26/30 Strand	Phase 2	Common	J3-B
J1-G	Green	#16 AWG 26/30 Strand		Close	J3-C
J1-F	Black	#16 AWG 26/30 Strand		Open	J3-D
J1-U	Red	#16 AWG 26/30 Strand		Common	J3-E
J1-R	Orange	#16 AWG 26/30 Strand		52b	J3-F
J1-P	Blue	#16 AWG 26/30 Strand		52a	J3-G
J1-L	White	#16 AWG 26/30 Strand	Phase 3	Common	J4-B
J1-K	Green	#16 AWG 26/30 Strand		Close	J4-C
J1-J	Black	#16 AWG 26/30 Strand		Open	J4-D
J1-U	Red	#16 AWG 26/30 Strand		Common	J4-E
J1-T	Orange	#16 AWG 26/30 Strand		52b	J4-F
J1-S	Blue	#16 AWG 26/30 Strand		52a	J4-G

SEL-C556

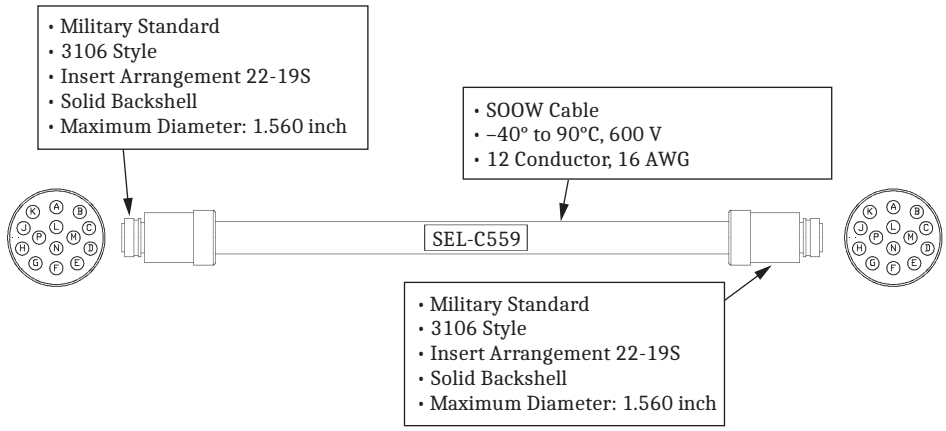
The SEL-C556 cable connects to three switches and the control power transformer through a Cooper junction box (drawing CCR116K1).



SEL-734W Pin	Function	Cooper Junction Box Pin
A	Control Power	A
B	Line Neutral	B
J	Phase 3 Open	J
K	Phase 3 Close	K
S	Phase 3 Status (52a)	S
T	Phase 3 Status (52b)	T
F	Phase 2 Open	F
G	Phase 2 Close	G
P	Phase 2 Status (52a)	P
R	Phase 2 Status (52b)	R
C	Phase 1 Open	C
D	Phase 1 Close	D
M	Phase 1 Status (52a)	M
N	Phase 1 Status (52b)	N
U	Phase 1, 2, 3 Status Common	U
V	Line Neutral	V
E	Not Connected	E
H	Not Connected	H
L	Not Connected	L

SEL-C559

The SEL-C559 cable connects to a junction box as per *Figure C.3* for end-user wiring.



Connector Pin	Wire Color	Wire Type	Function	Connector Pin
J1-A	Black	#16 AWG, Shielded	Reserved	J2-A
J1-B	White	#16 AWG, Shielded	Reserved	J2-B
J1-C	Red	#16 AWG, Shielded	Neutral Sensor, Positive Polarity	J2-C
J1-D	Green	#16 AWG, Shielded	Neutral Sensor, Common	J2-D
J1-E	Orange	#16 AWG, Shielded	A-Phase Voltage Sensor	J2-E
J1-F	Blue	#16 AWG, Shielded	B-Phase Voltage Sensor	J2-F
J1-G	White/Black	#16 AWG, Shielded	C-Phase Voltage Sensor	J2-G
J1-H	Red/Black	#16 AWG, Shielded	Voltage Sensor Common	J2-H
J1-J	Green/Black	#16 AWG, Shielded	Reserved	J2-J
J1-K	Orange/Black	#16 AWG, Shielded	Reserved	J2-K
J1-L	Blue/Black	#16 AWG, Shielded	Reserved	J2-L
J1-M	Shield	#16 AWG, Shielded	Reserved	J2-M
J1-N	N/A	N/A	Not Connected	J2-N
J1-P	N/A	N/A	Not Connected	J2-P

APPENDIX E

Enclosure Drawings

The following figures show a schematic diagram and a point-to-point wiring diagram of the internal wiring of the enclosures with all installed accessory options populated. Refer to the part number of your SEL-734W to determine which accessories are installed in your model.

Compact 4-Jaw Socket-Based Enclosure

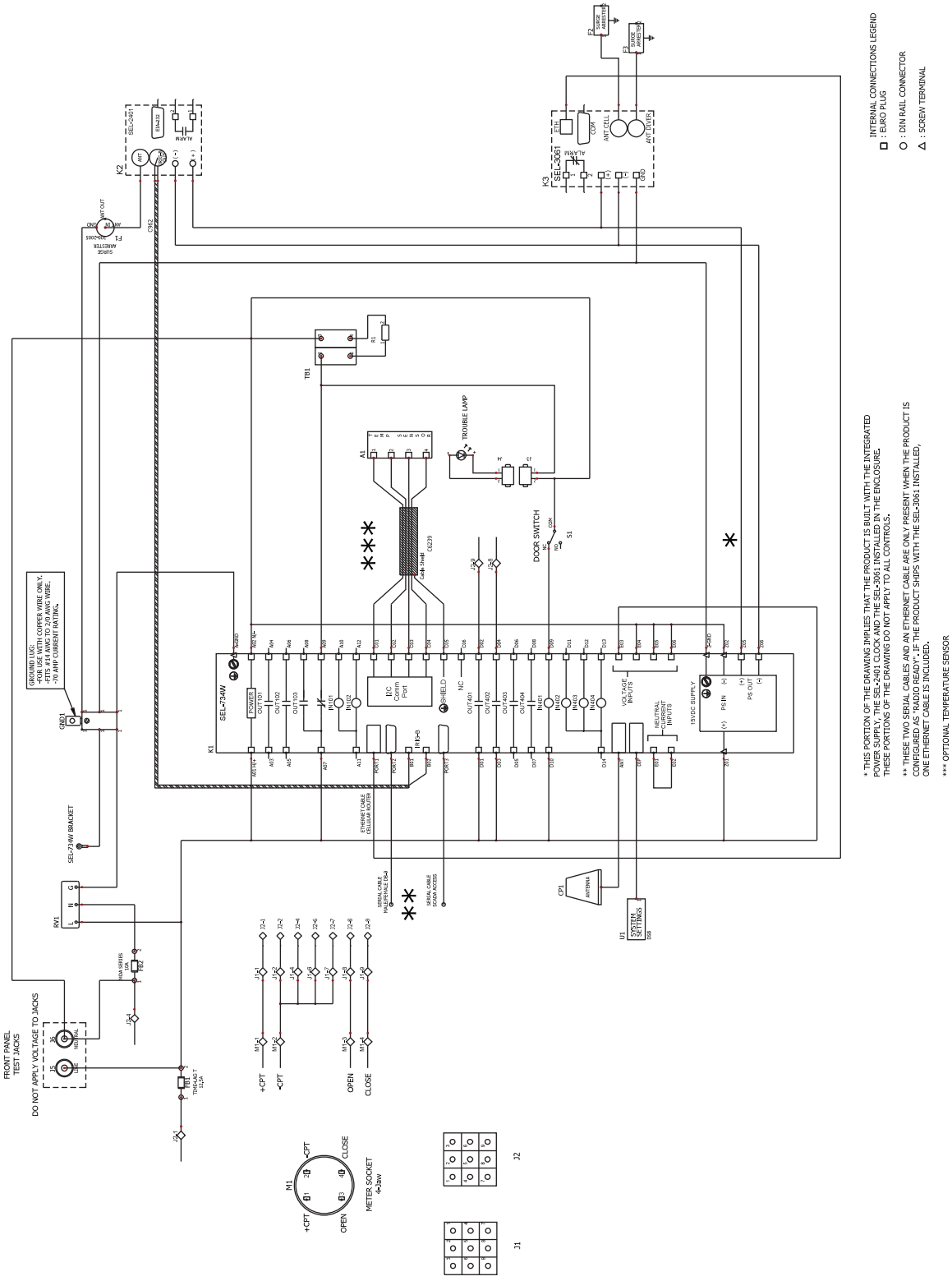


Figure E.1 Compact 4-Jaw Socket-Based Enclosure Schematic Diagram

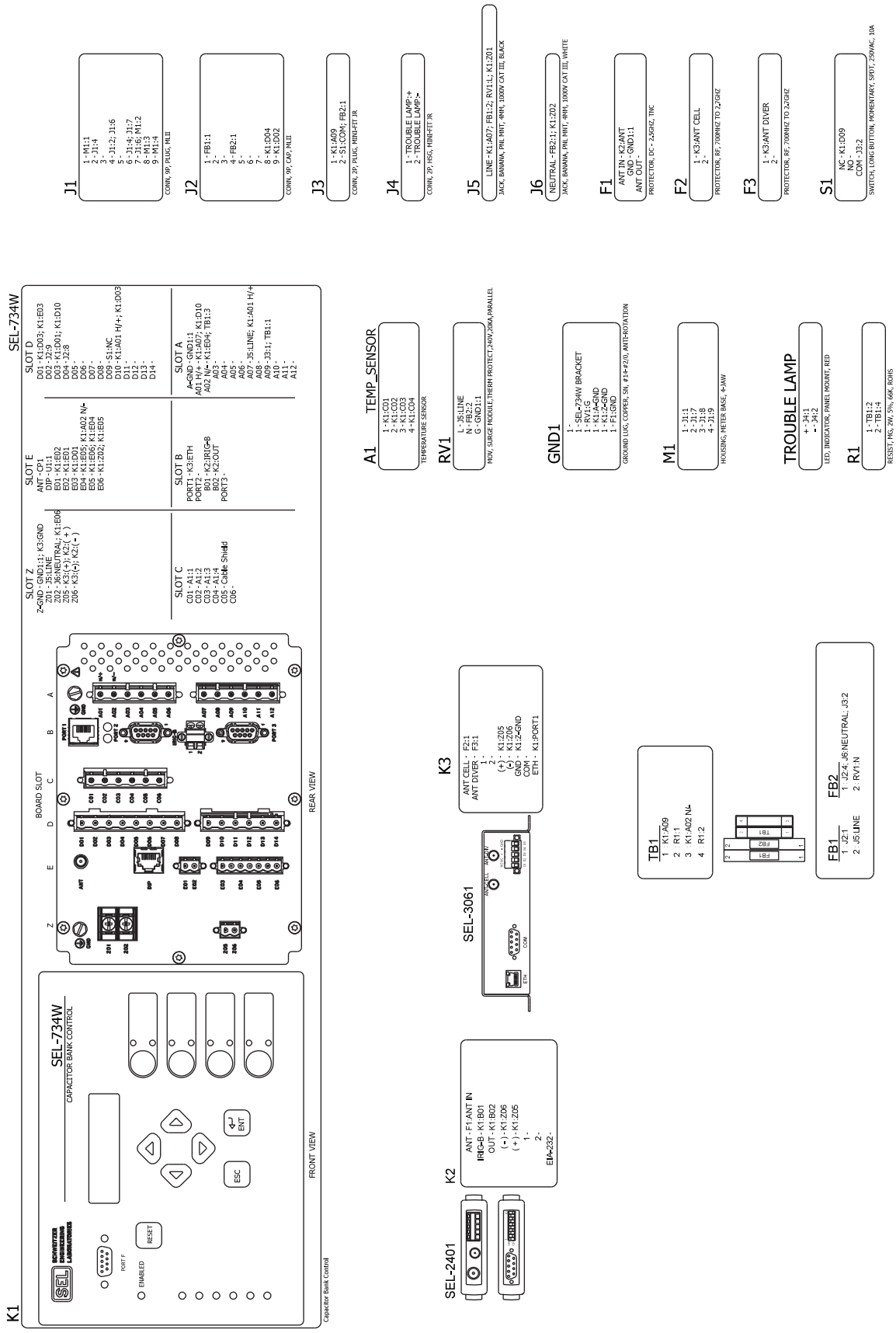


Figure E.2 Compact 4-Jaw Socket-Based Enclosure Point-to-Point Wiring Diagram

Compact 7-Pin Military Connector Enclosure

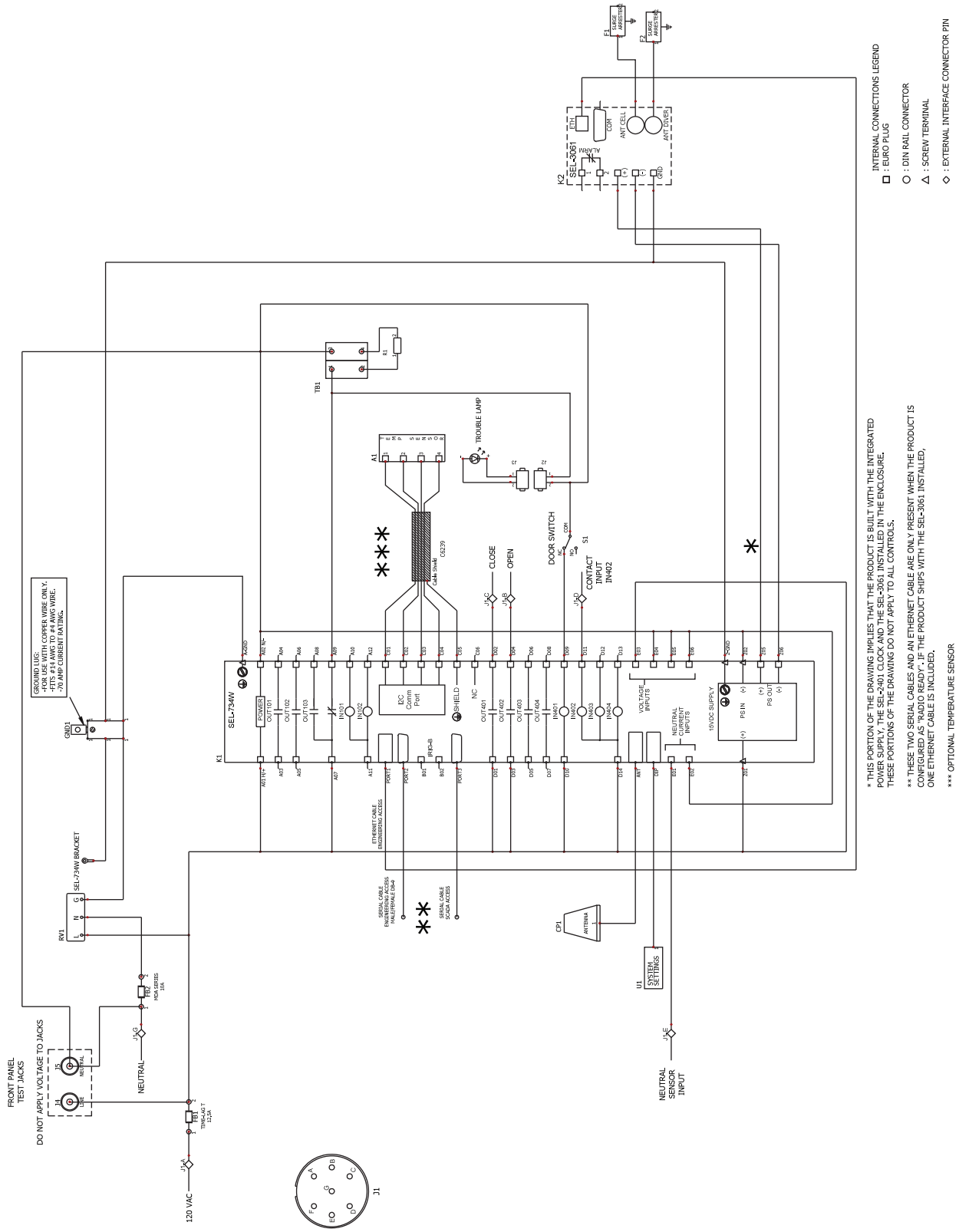


Figure E.3 Compact 7-Pin Military Connector Enclosure Schematic Diagram

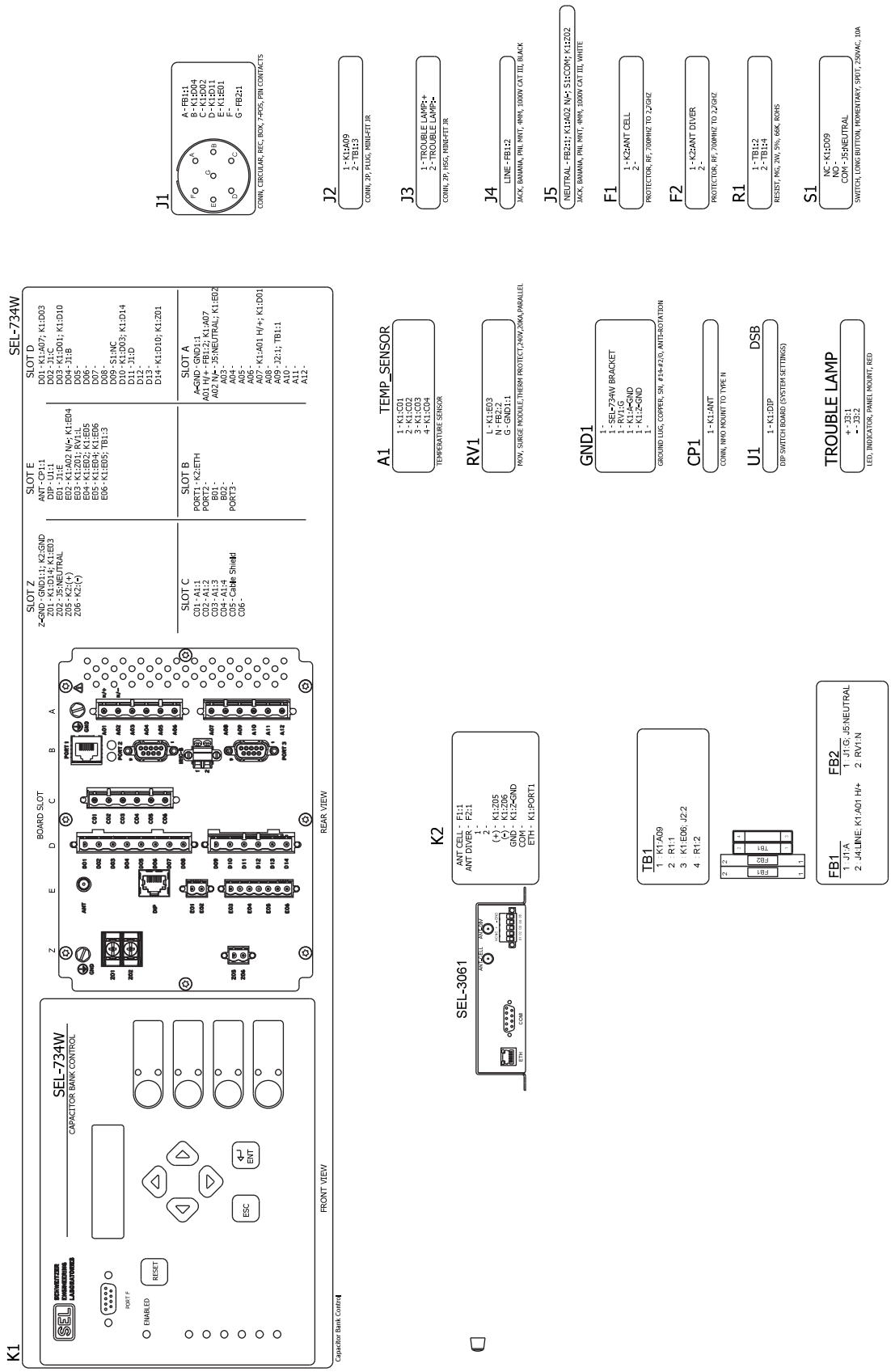


Figure E.4 Compact 7-Pin Military Connector Enclosure Point-to-Point Wiring Diagram

Compact 7-Pin Terminal Block Connector Enclosure

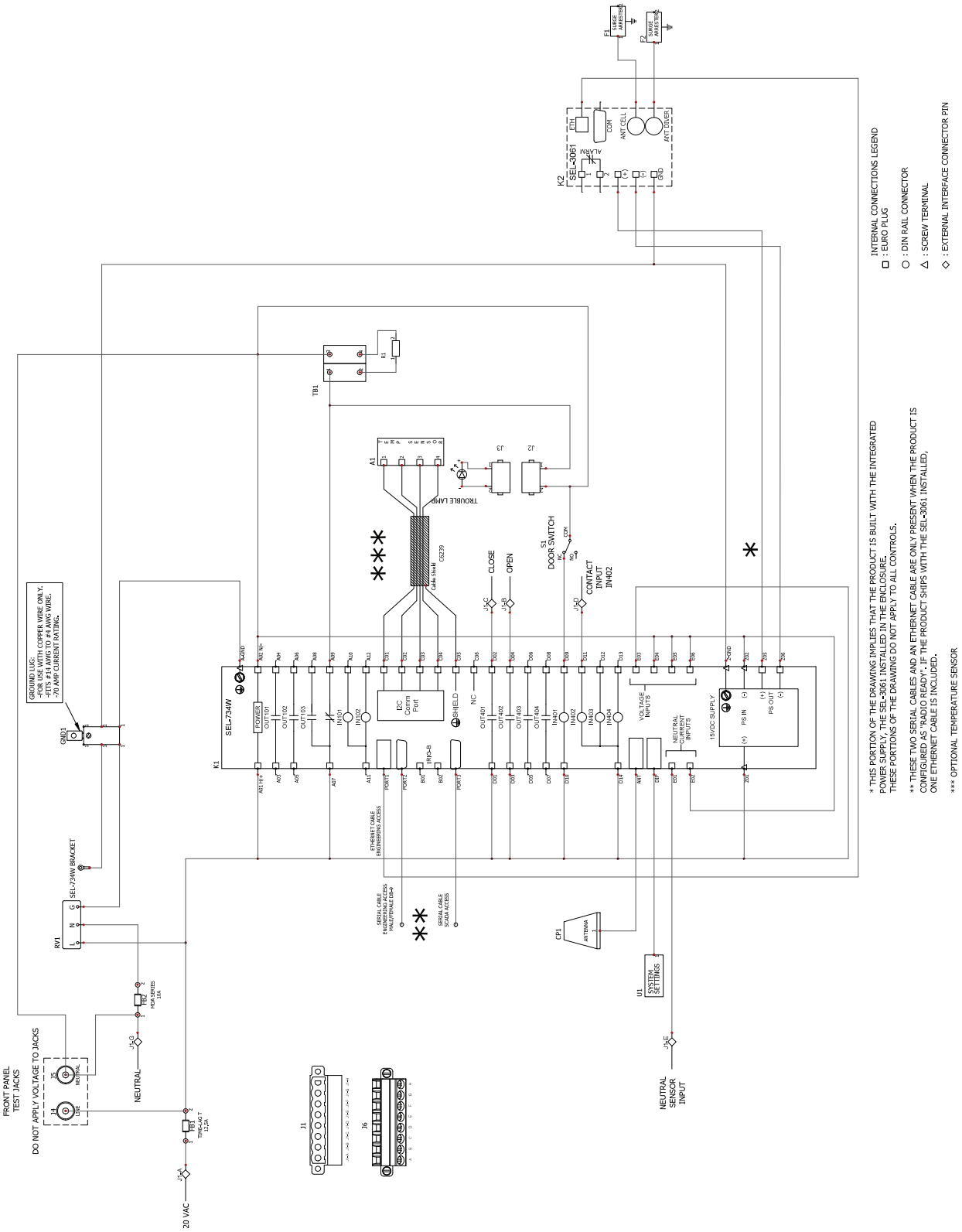


Figure E.5 Compact 7-Pin Terminal Block Connector Enclosure Schematic Diagram

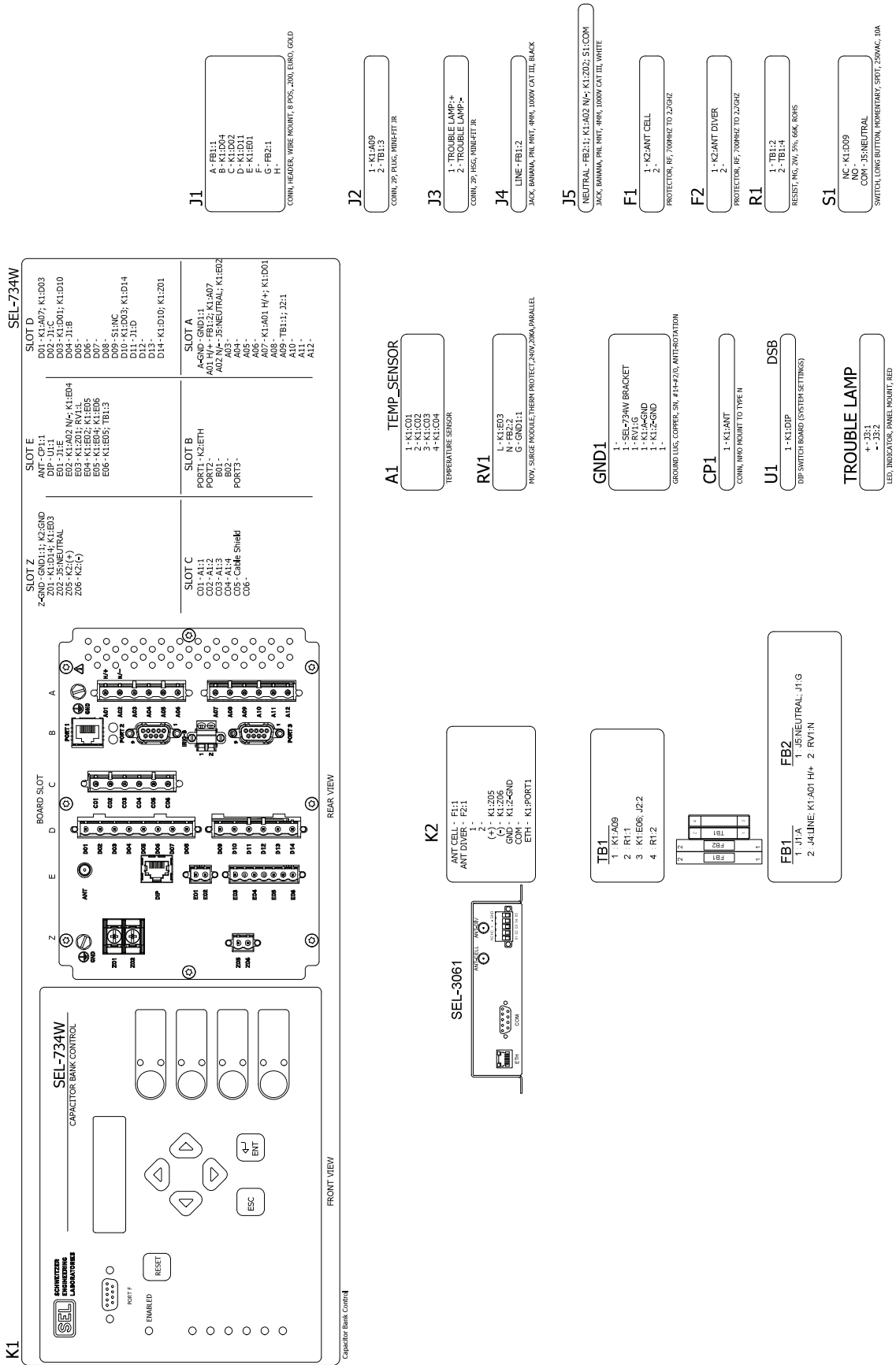


Figure E.6 Compact 7-Pin Terminal Block Connector Enclosure Point-to-Point Wiring Diagram

Full-Size Combined Sensor Connector Enclosure

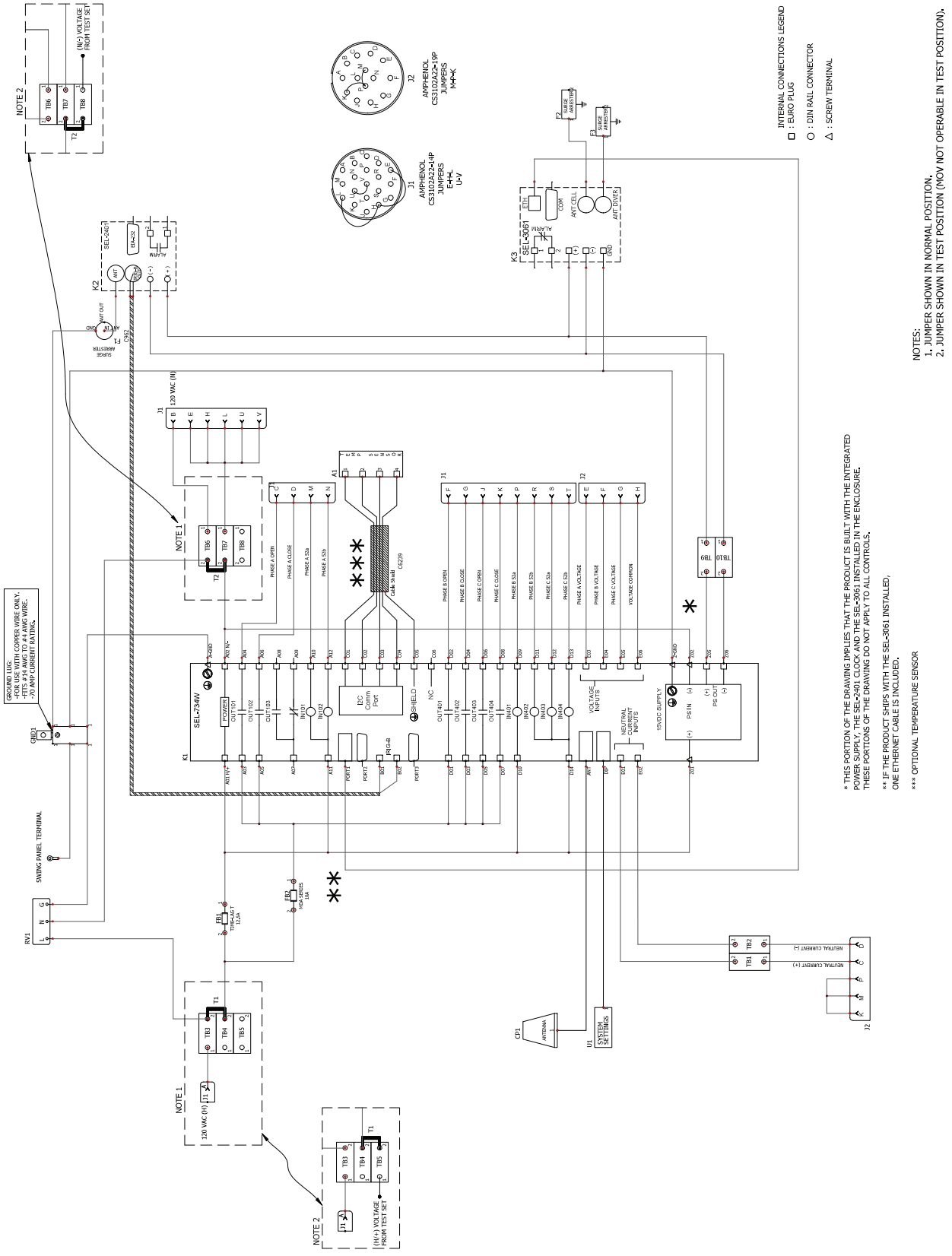


Figure E.7 Full-Size Combined Sensor Connector Enclosure Schematic Diagram

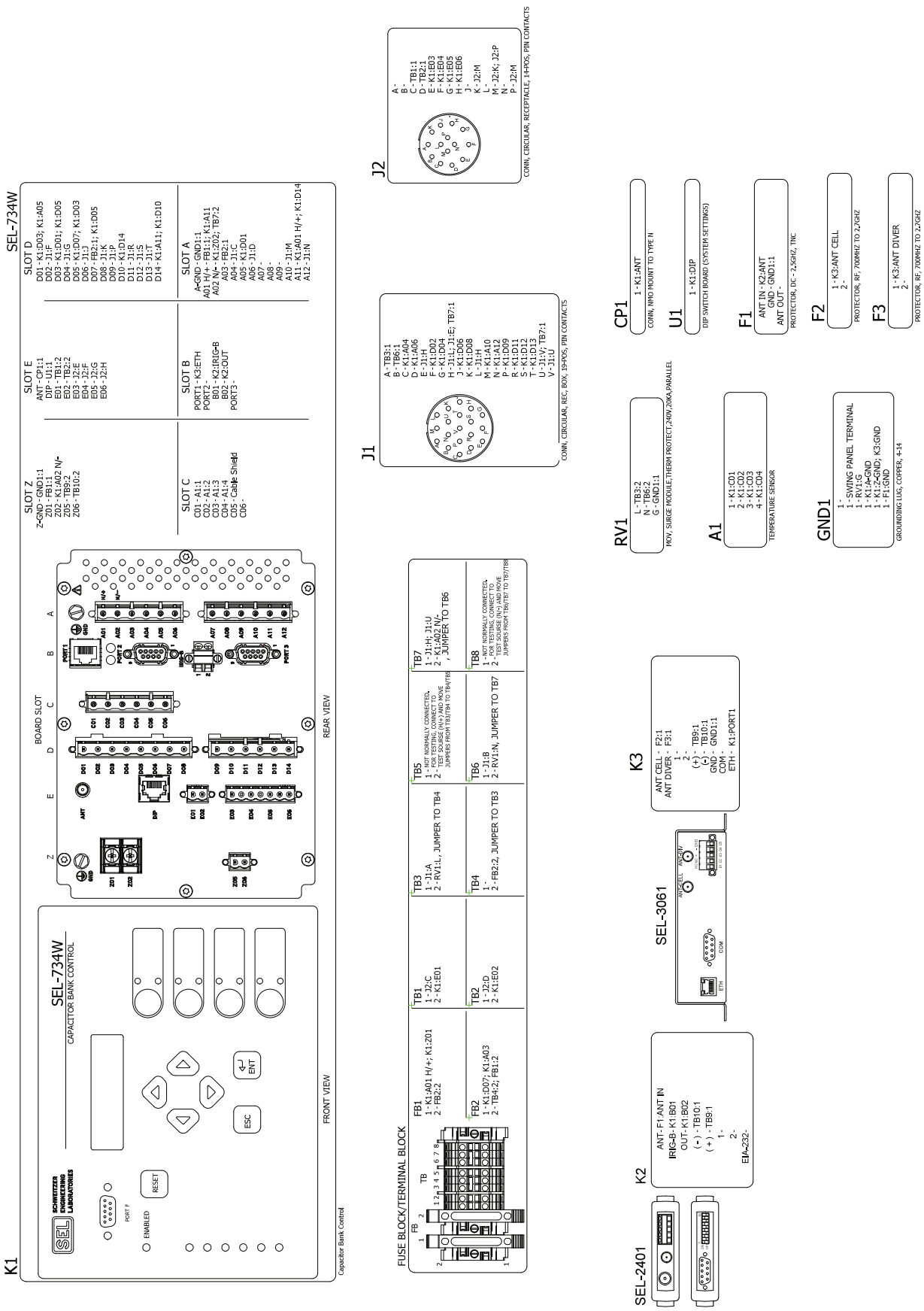


Figure E.8 Full-Size Combined Sensor Connector Enclosure Point-to-Point Wiring Diagram

Full-Size Individual Sensor Connector Enclosure

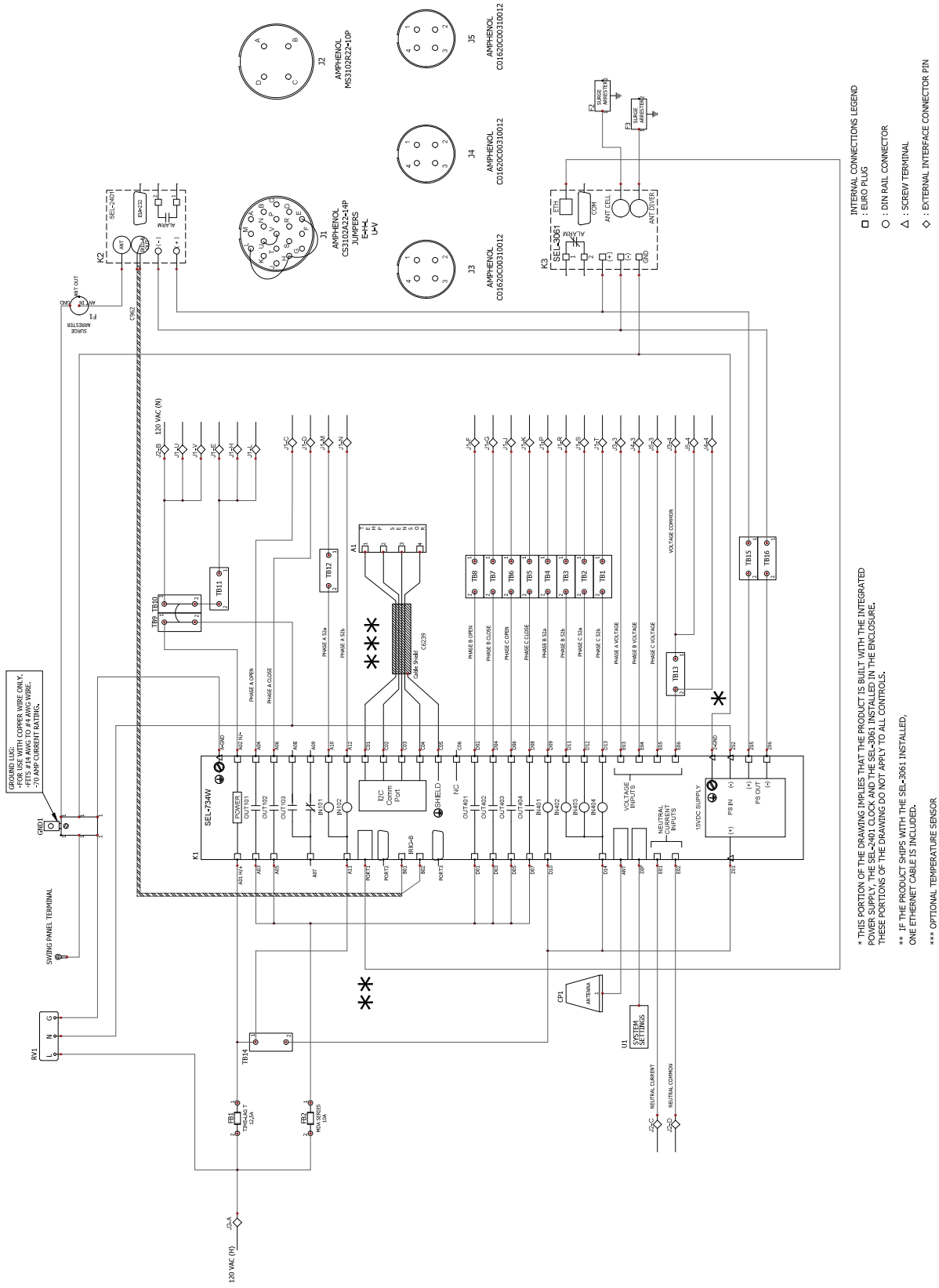


Figure E.9 Full-Size Individual Sensor Connector Enclosure Schematic Diagram

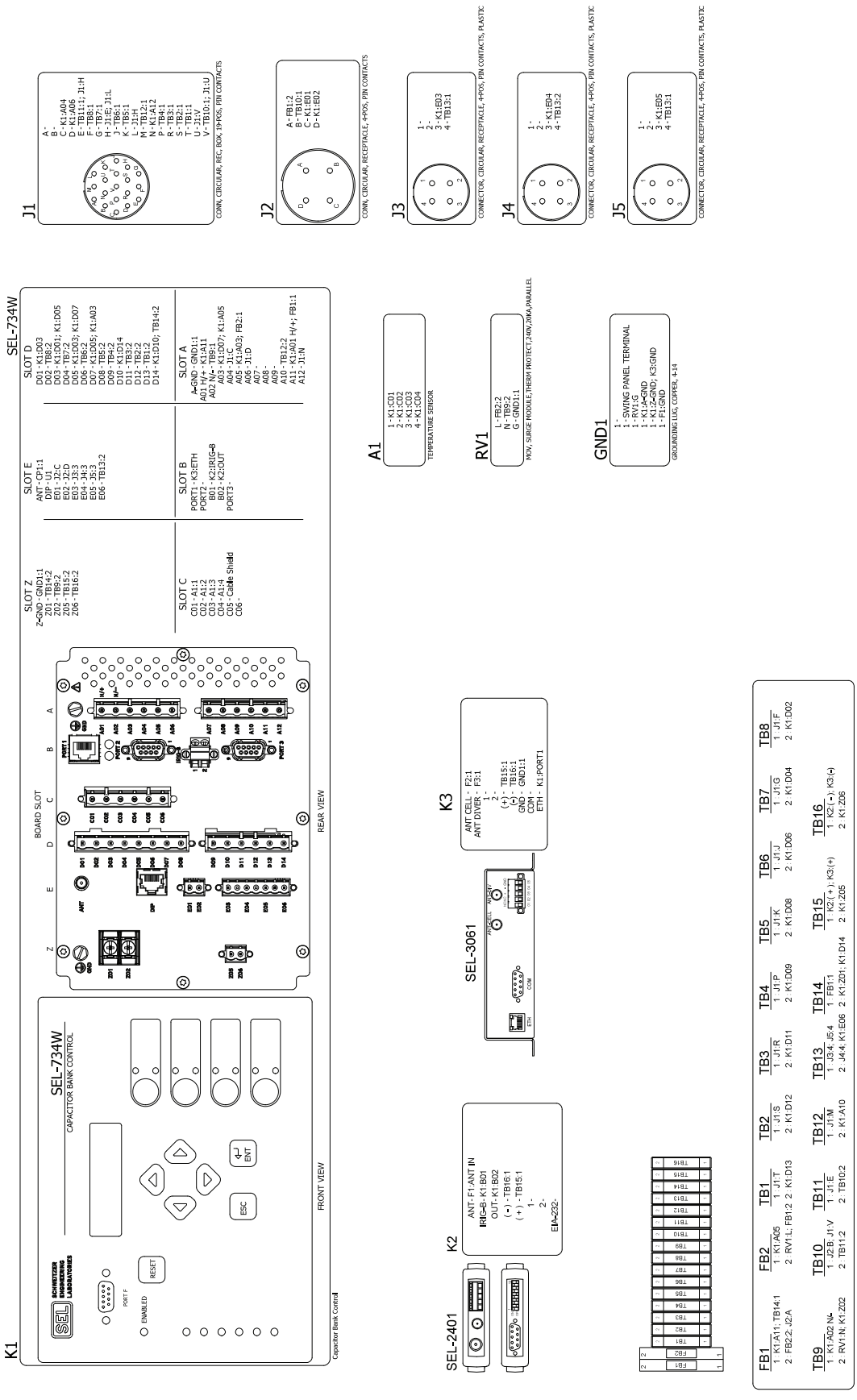


Figure E.10 Full-Size Individual Sensor Connector Enclosure Point-to-Point Wiring Diagram

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APPENDIX F

Accessories

Enclosure Accessories

This section describes the cables and accessories available with the SEL-734W enclosures.

Mounting

Part Number	Description
915900302	Meter locking ring. Compatible with the 4-jaw socket-based enclosure styles.
915900298	Pole-mounting bracket. Compatible with the 7-pin enclosure (Connectorized or terminal block) style (see *Figure 3.4*).

Control and Measurement

Part Number	Description
SEL-C558	Control and sensor cable. Compatible with the 7-pin Connectorized enclosure style. Connects to the following equipment: ➤ Control power transformer ➤ One trip/close switch circuit ➤ One contact input ➤ One neutral current sensor

Security Sleeves

The security sleeve for the Connectorized enclosure style shrouds the cable connection to prevent vandalism. The sleeve is made from stainless steel.

Part Number	Description
9250011	Security sleeve for the 7-pin Connectorized enclosure style.

Full-Size Enclosure Accessories

This section describes the cables and accessories available with the SEL-734W Full-Size Enclosures.

Mounting

A factory-installed pole-mounting bracket is an ordering option for the Full-Size Enclosure (see *Figure 3.2*). It is not available as a field-installed accessory.

Part Number	Description
915900448	Two stainless steel pole-mounting straps, 9-1/2" to 12-1/4" in diameter. Compatible with factory-installed mounting bracket.

Control Cables

The following cables are three-phase control cables that connect to three capacitor bank switches. Each cable also connect to a 120 Vac control power transformer (CPT).

Part Number	Description
SEL-C543	Cable with 52b feedback. Compatible with 5-pin capacitor bank switches.
SEL-C544	Cable with 52a/b feedback. Compatible with 6-pin capacitor bank switches.
SEL-C547	Cable with 52a/b feedback. Compatible with 7-pin capacitor bank switches.

The following control cable connects the SEL-734W enclosure to a Cooper CCR116K1 junction box.

Part Number	Description
SEL-C556	Cable with 52a/b feedback. Compatible with a Cooper CCR116K1 junction box. The SEL-C526 cable can be used to connect the junction box to an individual switch.

Security Sleeves

Security sleeves for enclosures with a combined sensor connector shroud a single cable connection to prevent vandalism. The sleeves are made from stainless steel. Separate security sleeves are required for each cable (i.e., one sleeve is required for the control cable, and one sleeve is required for the sensor cable.)

Part Number	Compatible Cables
9250011	SEL-C556, SEL-C558
915900311	SEL-C543, SEL-C544, SEL-C547

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