LINAM TPVS Test Point Voltage Sensor

Economically Detect Outages

Key Features and Benefits

The LINAM TPVS Test Point Voltage Sensor detects voltage loss from three test points and concentrates the voltage loss status of the distribution circuit into a single output contact. The sensor provides status via an output contact to the relay in a padmount or underground distribution source transfer scheme. The sensor sends its status to the relay to initiate a transfer to an alternate source when it detects test point voltage loss.

- **Economical.** Economically improve your source transfer scheme with voltage loss detection that is concentrated from test points to a single output contact.
- **Easy Installation.** Provide the simplest retrofit solution that eliminates cutting cables or directly connecting to medium voltage conductors.
- **Embedded Logic.** Rely on embedded logic to detect voltage loss, eliminating the need to measure voltage signals from analog sensors. Concentrating three sensors to a single output contact simplifies relay selection and programming to provide a more economical solution for the automatic transfer scheme.
- **Universal Compatibility.** Simplify inventory and specifications with vendor-neutral sensors for capacitive test points and basic insulating plugs (BIPs).
- **Simple Setup.** Rapidly deploy self-calibrating sensors with minimal effort to ensure your system is up and running.
- **Field-Accessible User Interface.** Easily adapt to application needs by using the high-visibility LEDs, configurable operating modes, and changeable voltage loss thresholds.

Product Summary

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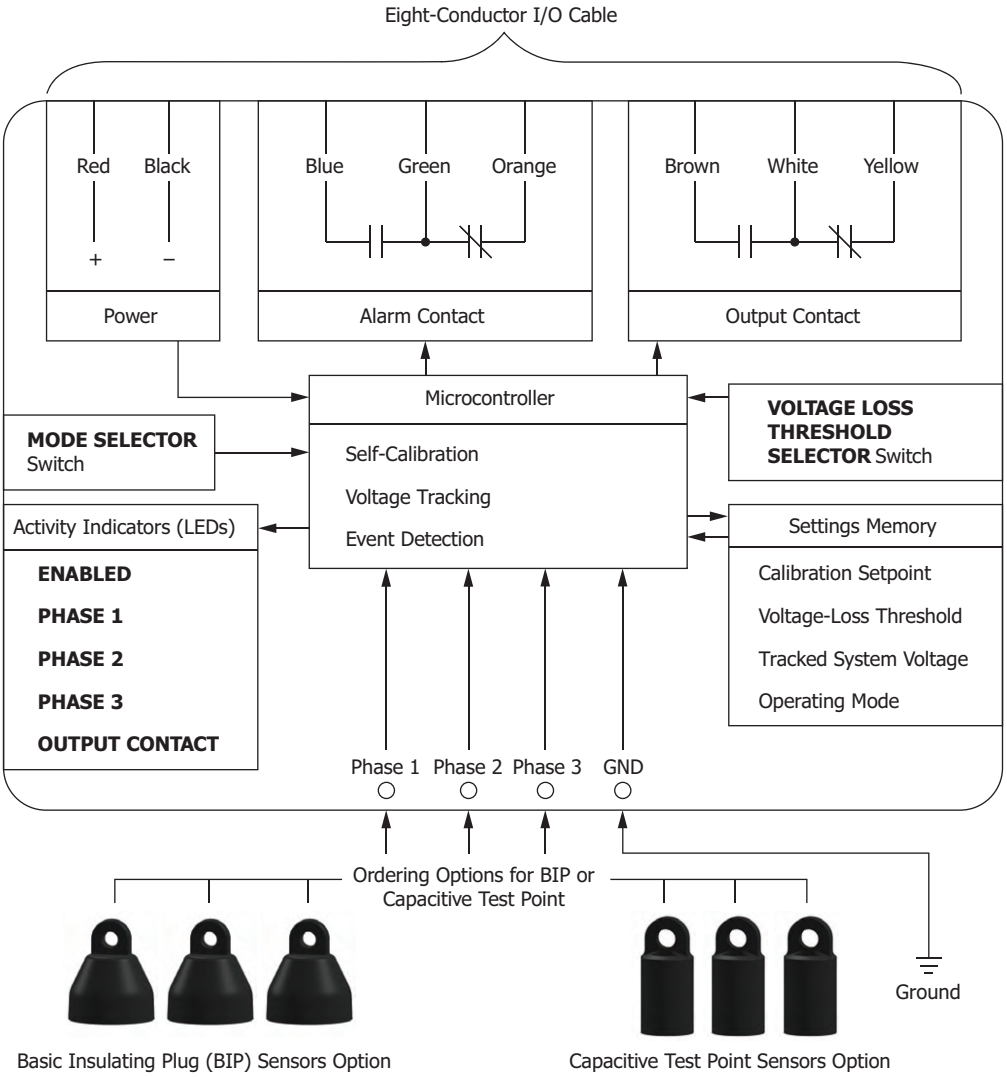


Figure 1 Functional Block Diagram

Standard Features

- Three sensors for test points. Ordering option specifies a set of three sensors for BIPs or a set of three sensors for capacitive test points.
- Control box with user interface.
- Two selector switches to set the mode and voltage loss threshold.
  - One **MODE SELECTOR** switch:
    - **CALIBRATE**
    - **3 PHASE LOSS**
    - **ANY PHASE LOSS**
  - One **VOLTAGE LOSS THRESHOLD SELECTOR** switch. Choose 50, 60, 75, or 85 percent of nominal phase-to-ground voltage
- LED display with five bi-color LEDs
  - One **ENABLED** LED
  - Three **PHASE** LEDs
  - One **OUTPUT CONTACT** LED
- One Form C output contact to indicate voltage presence loss
- One Form C alarm contact to indicate alarm conditions
- Power supply with 24 to 48 Vdc input range
- One eight-conductor I/O cable
- Four mounting tabs
- One ten-foot 14 AWG stranded ground wire

Ordering Options

You can order the following options for any TPVS model.

Test Point Phase Sensor Type:	Set of three phase sensors for BIP or Set of three phase sensors for capacitive test point
Sensor Cable Length:	3.7 m (12 ft) or 6.1 m (20 ft)
I/O Cable Length:	7.6 m (25 ft) or 15.2 m (50 ft)

Accessories

You can order the following accessories for any TPVS model.

Adapter Ring Kit:	Set of three spare rubber adapter ring inserts to mechanically fit phase sensors on Elasti-mold capacitive test points
Magnet Mount Kit:	Set of four high-strength rare earth magnets with screws, washers, nuts, and bushings to provide mounting solution for magnetic steel padmount enclosures
Sealing Kit for BIP:	Set of three worm-gear clamps to seal phase sensors to BIPs
Magnetic Cable Guide:	Cable guide with built-in magnets that keep phase sensor and I/O cables neat and secure

Event Detection From Test Points

The TPVS phase sensors detect outages by measuring the test point voltage to detect distribution system voltage loss. Unlike other devices, it attaches to the capacitive test point or BIP. The TPVS provides the simplest retrofit solution that eliminates cutting cables or directly connecting to medium voltage conductors. The TPVS monitors the test point voltage of each phase independently. Upon detecting a loss of test point voltage, the TPVS operates its output contact to signal voltage loss to the local relay (see *Figure 3*).

User-Initiated Self-Calibration

Test point capacitance varies across elbow types, manufacturers, manufacturing dates, voltage ratings, and test point locations. This results in a wide variance in test point voltage. Access the TPVS user-initiated self-calibration function by turning the **MODE SELECTOR** switch on the user interface to **CALIBRATE**. The TPVS learns the combination of the test point and system voltages. Within 30 seconds, the TPVS adapts to the unique voltage output of each test point and stores the calibration set points within its nonvolatile memory. The self-calibration function allows the same sensor to be reused after performing elbow replacements of the same test point type.

Voltage Tracking

The TPVS tracks the test point voltage of each phase independently. The sensor uses a long-term rolling average function to adapt voltage loss thresholds (per phase) to voltage variation over time. Voltage tracking helps filter out noise, spikes, and variations in voltage that occur normally on distribution systems. The sensor starts tracking system voltage after the user initiates self-calibration.

Alarm Conditions

The TPVS automatically monitors itself and alarms for error conditions, including low-input voltage, loss of input voltage, calibration error, and voltage-tracking error. Error conditions that impact the ability of the device to sense voltage presence or loss will cause a state change in the alarm contact.

Operator Controls

User-Interface

The user interface of the TPVS provides a simple way to quickly commission the sensor. Highly visible LEDs indicate calibration state, phase loss and presence and output contact state. Innovative selector switches communicate the mode and voltage loss threshold to the hall effect sensors embedded below the surface of the TPVS to ensure a watertight design.

Use the **MODE SELECTOR** switch to initiate self-calibration and select operating modes. Choose one of four voltage loss thresholds via the **VOLTAGE LOSS THRESHOLD SELECTOR** switch.

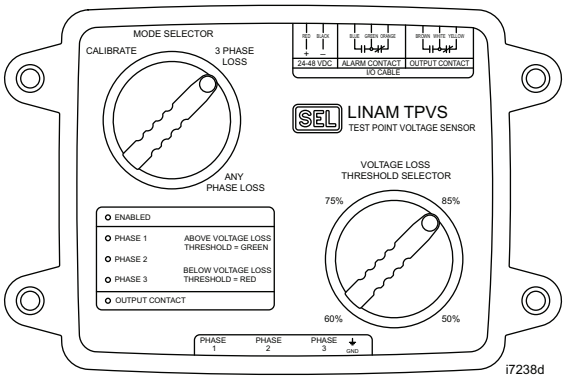
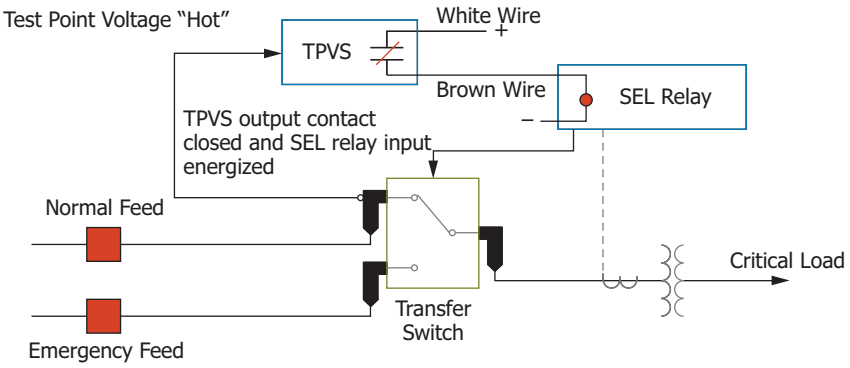


Figure 2 TPVS User Interface

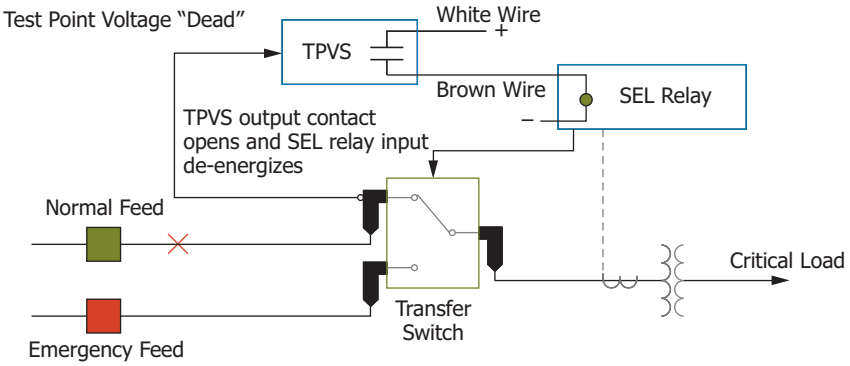
Application

Source Transfer Scheme for Critical Loads

During normal conditions, the critical load is served by the normal feed.



When a fault occurs on the normal feed and breaker opens, the TPVS output contact signals the SEL Relay that a loss of normal feed occurred.



When notified of a loss of normal feed, the SEL Relay switches the critical load to the emergency feed.

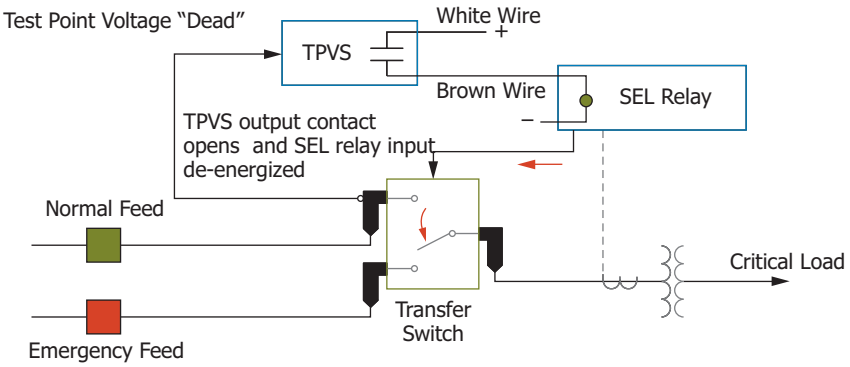


Figure 3 TPVS Signals a Loss of Normal Feed and the Critical Load Switches

Use the SEL relay as the switch control in your source transfer scheme. Connect the output contact of the TPVS to an input on the relay. When the relay detects an operation of the TPVS output contact, indicating an outage of a primary distribution source, the relay initiates a source transfer to the emergency (secondary) source. Apply additional TPVSs to each incoming source of the switch to provide redundant automation for outages of one or more sources. Apply a fault-sensing CT or sensor to the outgoing feed(s) of the switch to block source transfer into the faulted outgoing feed.

Specifications

Compliance

Designed and manufactured under an ISO 9001 certified quality management system

47 CFR 15B, Class A

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

General

Compatibility

Separable Connector Voltage Ratings:	15 kV, 25 kV, 28 kV, and 35 kV_{L-L} per IEEE 386
Distribution System Voltage Range:	2.5 kV to 35 kV_{L-L} per IEEE 386
Separable Connector Types:	Elbow or T-Body per IEEE 386
Test Point Styles:	Capacitive Test Point BIP per IEEE 386
Overload Withstand:	Meets Maximum Voltage Ratings per IEEE 386

Power Supply

Start-Up Time:	≤10 s
Rated Supply Voltage:	24–48 Vdc
Power Consumption:	2.5 W maximum
Interruptions:	50 ms
Supply Fluctuations:	±10%

Operating Characteristics

Maximum Time for Self-Calibration:	≤30 s
Voltage Loss Threshold Settings:	50%, 60%, 75%, and 85%
Voltage Presence Threshold:	5% (±1%) above the selected voltage loss threshold setting
Operating Modes:	Voltage loss of any phase Voltage loss of three phases
Nominal System Frequency:	40–66 Hz
Voltage Loss Detection Time:	10 cycles (±2 cycles)
Voltage Presence Detection Time:	10 cycles (±2 cycles)

Output Contacts (Electromechanical)

The TPVS supports two Form C output contacts for voltage loss indication and alarm.

Mechanical Endurance:	10,000 operations
Maximum Rated Voltage:	300 Vac/300 Vdc
Maximum Continuous Contact Current:	3 A
Operating Time:	Pickup time: ≤10 ms Dropout time: ≤5 ms
Voltage Rating Across Open Contacts:	300 Vac/300 Vdc

Operating Temperature

TPVS:	–40°C to +85°C (–40°F to +185°F)

Operating Environment

External Pollution Degree:	4
Relative Humidity:	5%–95%, noncondensing
Overvoltage Category:	3
Insulation Class:	Not Classified
Altitude:	5000 m

Weight

TPVS Control Box:	<2.7 kg (<5.0 lb)

Dimensions

TPVS Control Box:	168.7 mm x 254.5 mm x 62.2 mm (6.64 in x 10.02 in x 2.45 in)
TPVS Sensor for BIP:	104.1 mm x 88.7 mm (4.10 in x 3.49 in)
TPVS Sensor for Capacitive Test Point:	96.5 mm x 41.9 mm (3.8 in x 1.65 in)
I/O Cable Outer Diameter:	6.5 mm (0.256 in)
Ground Wire Diameter:	14 AWG
Ground Wire Length:	3.1 m (10 ft)

Type Tests

Electromagnetic Compatibility

Product Standards:	IEC 60255-26:2013 EN 60255-26:2013 KN 60255-26:2015 IEC 61000-6-2:2005 EN 61000-6-2:2005 IEC 61000-6-4:2006 + A1:2010 EN 61000-6-4:2007 + A1:2011
Emissions:	47 CFR Part 15.107, 109 ICES-001, Issue 5 KS C 9832:2015
Electrostatic Discharge:	IEC/EN 61000-4-2 IEEE C37.90.3 Contact Discharge: ±8 kV Air Discharge: ±15 kV
Surge Immunity:	IEC/EN 61000-4-5 ±2 kV L-L ±4 kV L-E
Surge Withstand Capability:	IEEE C37.90.1 2.5 kV Common and Transverse Oscillatory Test 4.0 kV Common and Transverse Fast Transient Test
Radiated RF Immunity:	EN 61000-4-3 10 V/m IEEE C37.90.2 20 V/m
Electrical Fast Transient Burst Immunity:	IEC 61000-4-4 4 kV at 5.0 kHz for all ports
Conducted RF Immunity:	IEC 61000-4-6 10 Vrms
Slow Damped Oscillatory Wave Immunity:	IEC/EN 61000-4-18 ±1 kV differential mode ±2.5 kV common mode
Power Frequency Magnetic Field Immunity:	IEC/EN 61000-4-8 IEEE 1613.1-2013 100 A/m for 60 seconds 1000 A/m for 3 seconds
Pulse Magnetic Field Immunity:	IEC/EN 61000-4-9 IEEE 1613.1-2013 1000 A/m
AC/DC Voltage Interruptions:	IEC/EN 61000-4-11 IEC/EN 61000-4-29

AC Component in DC (ripple):	IEC/EN 61000-4-17
Harmonics:	IEC/EN 61000-3-2
Flicker:	IEC/EN 61000-3-3

Environmental

Protection Ratings:	IPX8 for TPVS control box IPX8 for sensors for BIP when used with worm gear clamp IP67 for sensors for BIP without clamp sensors IP67 for sensors for capacitive test points
Vibration (Sinusoidal):	IEC/EN 60255-21-1
Shock/Bump:	IEC/EN 60255-21-2
Seismic:	IEC/EN 60255-21-3
Cold:	IEC/EN 60068-2-1
Dry Heat:	IEC/EN 60068-2-2
Damp Heat Cyclic:	IEC/EN 60068-2-30
Damp Heat Steady State:	IEC/EN 60068-2-78

Safety

Product Standards:	
Measuring Relays and Protection Equipment:	IEC 60255-27:2013 TPVS is evaluated for spread of fire only EN 60255-27:2014
Dielectric Withstand:	IEC/EN 60255-27 IEC/EN 62850-3
Impulse Severity:	IEC/EN 60255-27 IEC/EN 61850-3
Insulation:	IEC 60255-27 IEEE C37.90-2005

Processing Specifications

Voltage Measurement Error:	≤2.5% of calibrated voltage
Filtering:	15-minute infinite impulse response filter
Dynamic Range:	≥50% to ≤150% of calibrated voltage
Tracking Warning Indication:	≥50% to <60% of calibrated voltage >140% to ≤150% of calibrated voltage

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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