Installation

Table of Contents

April 27, 2026
© S&C Electric Company 1986–2026, all rights reserved

Qualified Persons

⚠ WARNING

Only qualified persons knowledgeable in the installation, operation, and maintenance of overhead and underground electric distribution equipment, along with all associated hazards, may install, operate, and maintain the equipment covered by this publication. A qualified person is someone trained and competent in:

- The skills and techniques necessary to distinguish exposed live parts from nonlive parts of electrical equipment
- The skills and techniques necessary to determine the proper approach distances corresponding to the voltages to which the qualified person will be exposed
- The proper use of special precautionary techniques, personal protective equipment, insulated and shielding materials, and insulated tools for working on or near exposed energized parts of electrical equipment

These instructions are intended only for such qualified persons. They are not intended to be a substitute for adequate training and experience in safety procedures for this type of equipment.

Read This Instruction Sheet

NOTICE

Thoroughly and carefully read this instruction sheet before installing or operating the Potential Device. Become familiar with the Safety Information on pages 3 through 4 and Safety Precautions on page 5. The latest version of this publication is available online in PDF format at **sandc.com/en/contact-us/product-literature/**.

Retain This Instruction Sheet

This instruction sheet is a permanent part of the Potential Device. Designate a location where users can easily retrieve and refer to this publication.

Proper Application

⚠ WARNING

The equipment in this publication is only intended for a specific application. The application must be within the ratings furnished for the equipment. Ratings for the Potential Device are listed in the ratings table in Specification Bulletin 581-31. The ratings are also on the nameplate affixed to the product.

Understanding Safety-Alert Messages

Several types of safety-alert messages may appear throughout this instruction sheet and on labels and tags attached to the product. Become familiar with these types of messages and the importance of these signal words:

⚠ DANGER

"DANGER" identifies the most serious and immediate hazards that will likely result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ WARNING

"WARNING" identifies hazards or unsafe practices that can result in serious personal injury or death if instructions, including recommended precautions, are not followed.

⚠ CAUTION

"CAUTION" identifies hazards or unsafe practices that can result in minor personal injury if instructions, including recommended precautions, are not followed.

NOTICE

"NOTICE" identifies important procedures or requirements that can result in product or property damage if instructions are not followed.

Following Safety Instructions

If any portion of this instruction sheet is unclear and assistance is needed, contact the nearest S&C Sales Office or S&C Authorized Distributor, or call the S&C Global Support and Monitoring Center at 1-888-762-1100. Telephone numbers are also listed on S&C's website, **sandc.com**.

NOTICE

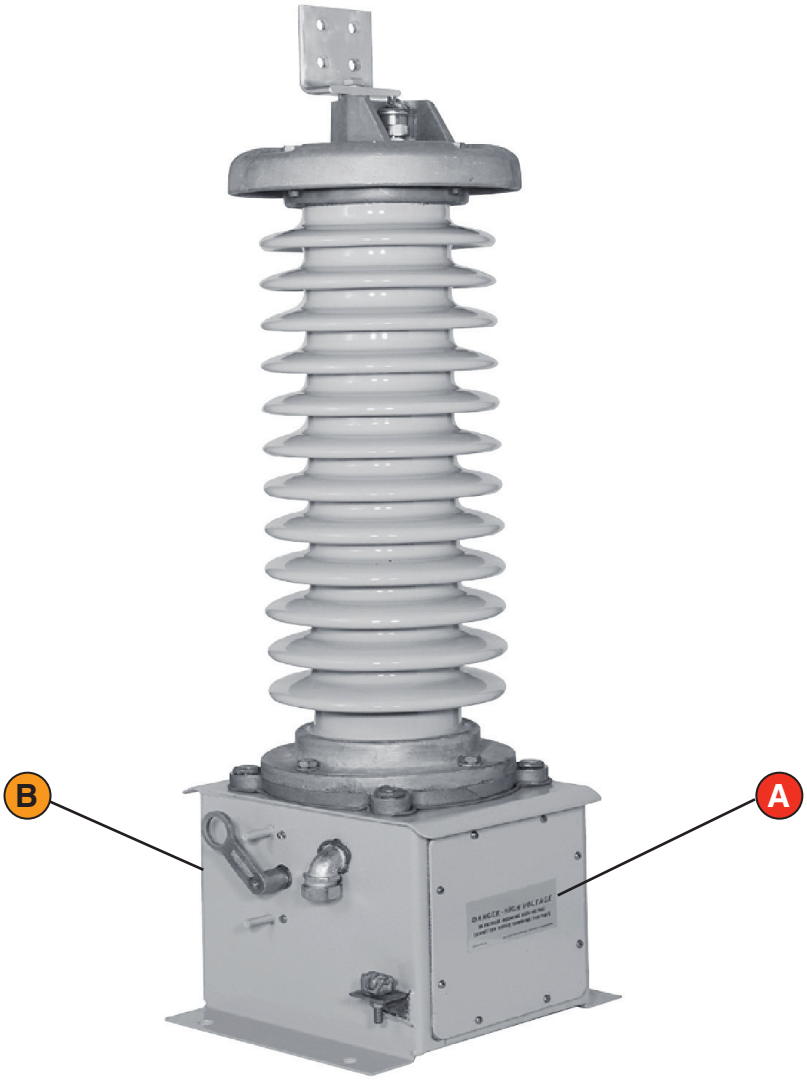
Read this instruction sheet thoroughly and carefully before installing the Potential Device.

Replacement Instructions and Labels

If additional copies of this instruction sheet are required, contact the nearest S&C Sales Office, or S&C Authorized Distributor, or S&C Headquarters, or S&C Electric Canada Ltd.

It is important any missing, damaged, or faded labels on the equipment be replaced immediately. Replacement labels are available by contacting the nearest S&C Sales Office or S&C Authorized Distributor, or S&C Headquarters, or S&C Electric Canada Ltd.

Location of Safety Labels



Reorder Information for Safety Labels

Location	Safety Alert Message	Description	Part Number
A	⚠ DANGER	High Voltage. De-energize incoming high-voltage connection before removing this plate.	G-3959
B	⚠ WARNING	Grounding switch removes voltage to external burden only.	G-3960

⚠ DANGER

The Potential Device operates at high voltage. Failure to observe the precautions below will result in serious personal injury or death.

Some of these precautions may differ from your company's operating procedures and rules. Where a discrepancy exists, follow your company's operating procedures and rules.

1. **QUALIFIED PERSONS.** Access to the S&C Potential Device must be restricted only to qualified persons. See the "Qualified Persons" section on page 2.
2. **SAFETY PROCEDURES.** Always follow safe operating procedures and rules.
3. **PERSONAL PROTECTIVE EQUIPMENT.** Always use suitable protective equipment, such as rubber gloves, rubber mats, hard hats, safety glasses, and flash clothing, in accordance with safe operating procedures and rules..
4. **SAFETY LABELS.** Do not remove or obscure any of the "DANGER," "WARNING," "CAUTION," or "NOTICE" labels.
5. **ENERGIZED COMPONENTS.** Always consider all parts live until de-energized, tested, and grounded.

Application Overview

S&C 15-Volt-Ampere Potential Devices are applicable only for neutral-to-ground connection on ungrounded, Wye connected shunt capacitor banks and reactors. They are suitable for use in conjunction with equipment having high-impedance input circuits, such as the S&C Bankgard™ Relay—Type LUC. (The potential device can also be used with discontinued S&C Automatic Control Device—Type UP, UP/VR, or UPR.) For intermediate-tap point-to-ground connections on grounded, Wye connected shunt capacitor banks, and for line-to-ground connection in all other applications, S&C 30-Volt-Ampere Potential Devices are to be used. Refer to S&C Instruction Sheet 581-500.

S&C 15-Volt-Ampere Potential Devices are resistance-type voltage-sensing devices having constant-current output, like current transformers. An adjustable burden resistor, contained within the base of the unit and connected across the output terminals, produces an output voltage which is directly proportional to the voltage applied to the line terminal. This burden resistor is factory calibrated to provide a specific ratio of applied voltage to output voltage.

Unlike capacitor-coupled devices, S&C 15-Volt-Ampere Potential Devices do not possess resonant characteristics and are immune to ferroresonance. Their limited frequency response makes them ideal for service at locations where high-frequency transients might otherwise cause spurious relay operations.

Furthermore, unlike voltage transformers, S&C 15-Volt-Ampere Potential Devices do not saturate when subjected to switching overvoltages. They are therefore better suited to neutral-voltage monitoring application in capacitor-bank and shunt-reactor protection schemes. Typically, in such applications, transient overvoltages on the order of 0.5 to2.4 per unit can be developed at the bank's neutral as a result of normal switching operations. Since S&C 15- Volt-Ampere Potential Devices are immune to these voltage surges, they can be applied in ratings one or more levels below the system nominal voltage to provide increased sensitivity.

The following table summarizes S&C's recommended voltage ratings for 15-Volt-Ampere Potential Devices applied for neutral-to-ground voltage monitoring on ungrounded, wye-connected shunt capacitor banks and reactors.

Table 1. Recommended Voltage Ratings

Nominal Source Voltage, kV	15-Volt-Ampere Potential Device System Voltage Rating, kV, Nom.	Voltage Ratio●
below 23	23	111:1
23	23	111:1
34.5	23	111:1
46	23	111:1
69	34.5	166:1
115	69	332:1
138	69	332:1
161	138	664:1
230	138	664:1

● Factory calibrated to provide the voltage ratio shown with an applied voltage of 1000 volts ac.

Although special consideration to lightning exposure is unnecessary, it is desirable, as with voltage transformers and other electrical apparatus, to provide surge arresters if the prevalence of lightning warrants.

Construction

S&C 15-Volt-Ampere Potential Devices use a high-voltage resistor assembly immersed in insulating oil and sealed in a wet-process porcelain bushing. See Figure 1 on page 7. A measured amount of air is left above the oil level to permit expansion and contraction of the oil volume with temperature changes; a pressure-relief valve is incorporated in the cover of the potential device to prevent excessive pressure buildup during normal operation under high ambient-temperature conditions. Because the pressure-relief valve opens only if the internal pressure reaches a level of 9 to 11 psig, and then only momentarily, the resistor assembly is essentially sealed so that moisture contamination and sludging tendencies are virtually eliminated.

The resistor assembly is comprised of a large number of high-precision thick-metal-film resistors connected in series. The individual resistors have a temperature coefficient of less than 0.01% per degree C, over a temperature range of -55 ºC to +175 °C, ensuring an exceptionally high degree of temperature stability. The top cover of the device, to which the resistor assembly is internally connected, is provided with (if specified at time of ordering) either parallel-groove type connector for use with wire conductors, or a vertical-pad line terminal with standard four-hole drilling for use with bus or pad-terminal connectors. At the base of the device, a stud connected to the resistor assembly is brought through an O-ring sealed Cypoxy® insulator plate into the base enclosure, where connection is made to the primary side of the series transformer, and to a spark over gap which limits high voltages which might appear at the transformer primary because of line surges or an inadvertent open secondary circuit.

The neutral end of the series-transformer primary winding is permanently connected to the transformer case, which is grounded. The secondary winding is completely isolated and has a low-frequency withstand to ground of 2.5 kV for one minute. A removable jumper is furnished, connected from the X2 secondary winding

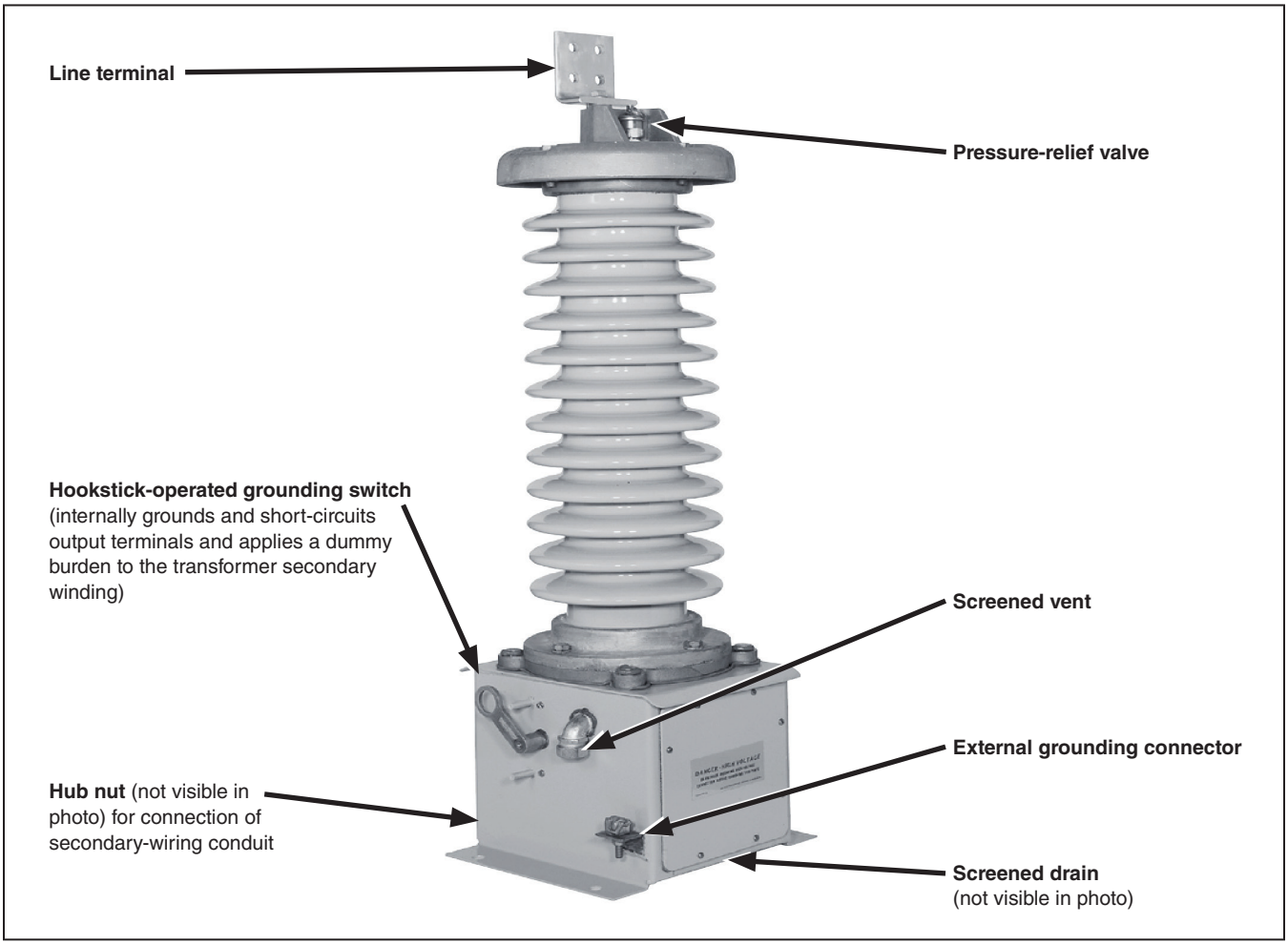


Figure 1. S&C 15-Volt-Ampere Potential Device, Catalog Number 81573R1, rated 23 kV.

terminal to ground. (The jumper may be removed if single point grounding at another location is desired.) This transformer is essentially a current transformer in that its primary current is that of the potential-device resistor and is independent of the secondary burden. It has a turns ratio of 63 to 1.

The primary of the transformer (connected in series with the potential-device resistor) is energized in direct proportion to the capacitor-bank or reactor neutral-to ground voltage, but like any current transformer, a closed secondary must be maintained whenever current is flowing in the primary.

If the secondary circuit is open, all of the primary current is used for magnetizing the core and the resulting high flux densities, limited only by saturation of the core, will induce high voltages which may cause permanent insulation damage to the transformer.

A hookstick-operated grounding switch is provided in the base of the potential device. The switch, when placed in the "ground" position, short-circuits and grounds the potential-device output terminals T1 and T2 and at the same time connects an internal dummy-burden resistor across the secondary winding of the transformer. See Figure 2.

Note that the grounding switch short-circuits and grounds the external burden only. The transformer will remain energized until the high-voltage connection to the potential device is removed or de-energized.

A weather-tight hub nut is provided for the secondary wiring conduit connection.

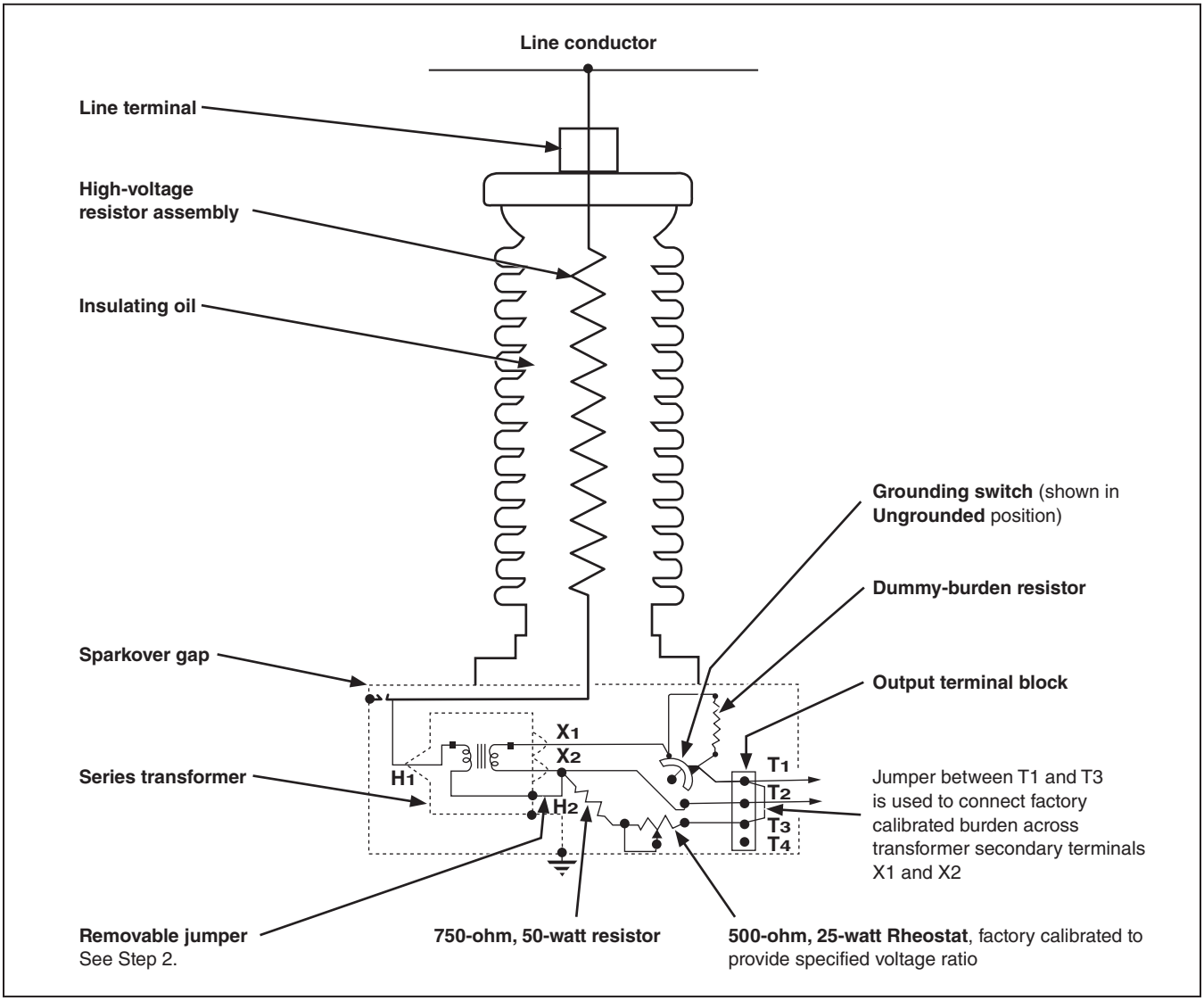


Figure 2. S&C 15-Volt-Ampere Potential Device schematic.

To install the potential device, complete the following steps:

STEP 1. Mount the potential device on the S&C Mounting Pedestal (if furnished) or other suitable structure.

NOTICE

The potential device is intended for vertical mounting only.

STEP 2. Remove the potential-device base cover nearest the conduit hub nut. Install one-inch conduit between the potential device and the S&C Automatic Control Device—Type UP, UP/VR, or UPR, or the S&C Bankgard Relay—Type LUC.

Install the connections in accordance with the wiring diagram furnished with the automatic control device or Bankgard relay, as applicable, If single-point grounding at another location is desired, remove the jumper connected between the potential device transformer secondary bushing and the transformer case, and connect Terminal T2 to the selected grounding point.

Replace the potential-device base cover.

STEP 3. When the potential device is used in conjunction with S&C Automatic Control Device—Type UP, UP/VR, or UPR, the burden resistor contained in the voltmeter module of the automatic control device must be disconnected as follows:

For a Type UP or Type UP/VR Automatic ***Control Device having catalog number supplement "R2" or higher, or a Type UPR Automatic Control Device having catalog number supplement "R1" or higher:*** Place the miniature toggle switch, located near the rear of the voltmeter module printed circuit board, in the "BURDEN OUT" position.

For all other (earlier) Type UP, UP/VR, and UPR Automatic Control Device models—which do not incorporate the burden-isolating toggle switch: Cut the leads and remove the 500-ohm, 7.5-watt burden resistor located near the rear of the voltmeter module printed circuit board.

STEP 4. Make sure the capacitor-bank or reactor switching device is locked open and the capacitor bank or reactor is grounded. Then connect the capacitor-bank or reactor neutral to the line terminal of the potential device.

STEP 5. Remove the temporary grounds from the capacitor bank or reactor.

STEP 6. Refer to the instruction sheet furnished with the S&C Automatic Control Device—Type UP, UP/VR, or UPR, or S&C Bankgard Relay—Type LUC, and proceed as directed therein.