DistribuSense® medium voltage outdoor sensors
Current, voltage and combination line post sensors
Instructions for installation, use and maintenance
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SAFETY NOTICE

- Keep these instructions available to those responsible for product’s proper installation, maintenance and operation.
- Follow your company’s safety procedures.
- Read these instructions carefully before attempting to install, operate, or maintain this device. Failure to follow these instructions could cause severe personal injury, death, or property damage.
- Apparatus covered by this instruction literature should be operated and serviced only by competent personnel familiar with good safety practice. These instructions are written for such personnel and are not intended as a substitute for proper training and experience in safety procedures for this type of equipment.
Instructions for application, installation and use of VLS, VCS, WLS, VKS and KLS line post sensors

This application, installation and use guide is valid for outdoor medium voltage line post sensors which are included as part of ABB’s DistribuSense® sensor family. These line post sensors include voltage and current only sensors, as well as combination sensors that combine voltage and current sensing in one device.

1.1 Operating Conditions

ABB’s medium voltage line post sensors are designed to be installed and operated on 15-34.5 kV overhead lines in outdoor conditions. These sensors are rated for ambient temperatures between -50°C and +70°C (storage and transportation temperatures in the same range). These sensors are designed and tested for applications under 1000 meters above sea level. Contact the factory or your ABB sales representative for applications above 1000 meters.

For insulation and protection, the assemblies are cast in hydrophobic cycloaliphatic epoxy (HCEP). The HCEP material offers superior arc track, ozone, and ultraviolet-resistive properties while maintaining physical strength. The hydrophobic surface properties of HCEP ensure highly reliable performance in wet, humid or contaminated environments.

Before mounting, ensure that the characteristic data on the rating label matches the requirements of the power system.

1.2 Technical Details

For sensor dimensions, see dimensional drawings in the product literature. Rated values for each individual sensor are stated on the rating label of the sensor.

1.3 Installation Instructions

1.3.1 Safety instructions

Always ground the sensor by grounding the mounting bolt on the base of the sensor or the separate self-locking ground terminal screw.

Sensors have low power output signals which is a safety benefit compared to traditional instrument transformers. There is not dangerous high voltages at the sensor output and the secondary can be left open (current sensors) or short-circuited (voltage sensors) without concern.

The VCS, VKS, WLS and KLS can be used as a post insulator, however the VLS cannot be used as a support structure for the line.

While inserting the primary cable into the top of the post insulator sensors (VCS, VKS, WLS, KLS), ensure that it does not fall to the side or bottom of the sensor. During a live installation it is imperative that the primary cable does not approach or contact the secondary cable or ground. The VCS and VKS sensors are designed with a “v-shaped” cable capture feature at the top of the sensor to make it easier to install the live cable (see figure 1).

1.3.2 Handling

Line post sensors should be lifted with straps or by hand using the bushing sheds as shown in figure 2, not lifted by the secondary cable or primary connection point. The sensor and cable bundle should be lifted together to avoid any stress between the interface of the sensor and cable.
1.3.3 Secondary connections

The secondary cable is a single cable designed and tested for each sensor. It should not be extended, shortened, branched, modified, or changed. Any of these things void the guarantee of accuracy and performance of the sensor. The cable should be protected against any cut or damage during installation.

It is important when installing cables on outdoor sensors that the connector pins and faces must be dry before connecting to the controller or sensor. In rainy or wet conditions moisture can accumulate on the connector pins, which can shift the accuracy readings of the sensor. If a shift in accuracy due to moisture presence occurs, it is a temporary effect and when the moisture dries, the accuracy values go back to normal which will typically match the accuracy observed in factory testing.

For consistency, ABB line post sensors use a 4-pin threaded connector for both combination and current or voltage only sensors. For combination sensors all 4 pins are used. However, in the case of voltage or current only sensors, not all pins are used. See section 1.4 for specific sensor output configurations.

If a bayonet or other style connector is desired, a short adapter cable can be installed in the factory to convert from the threaded connector to the desired connector. This adapter cable is installed under factory conditions to ensure there is no possibility for water ingress or cross threading.

When connecting the secondary cable to the electronic measurement equipment, ensure the secondary cable is routed separately from the power cables. The minimum acceptable bending radius and operating temperature range for each sensor cable is shown below in section 1.4.

1.3.4 Connection to the IED

To ensure accurate measurement and proper performance, the sensor and IED must be compatible. Due to the wide variety of relays and controllers offered in the market today, contact the factory or your ABB sales representative to ensure sensor compatibility. Compatibility testing and compatibility calculations can be done at the factory as requested.

Sensors are low power devices and cannot be used to power IEDs. The IED must be connected to an external power supply, such as a VT.

1.3.5 Securing the secondary cable

Any extra length of cable should be looped and secured with cable ties as shown in figure 3 below. It is recommended to loop the extra length of cable near the secondary connection side so that it remains safe and away from other power conductors during operation.

The secondary cable is not insulated for medium voltage. If a medium voltage line inadvertently touches the secondary cable it could cause a short to ground, causing a safety risk and potential damage to the sensor.

1.3.6 Mounting

The mounting bolt can be used to secure the sensor to a wooden or metal cross-arm, rack or other application such as in a pad mounted cabinet. This mounting bolt the self-locking 1/4”-20 screw terminal on the back of each sensor provide the capability of making the ground connection. This connection can be made with a ring terminal or bare wire smaller than 0.264” (6.7mm). See the examples in figure 4 below for the mounting bolt and grounding terminal on VLS and VCS sensors. Torque values for the mounting bolt are given for each sensor in section 1.4 below. The recommended torque for the self-locking ground terminal screw is 5-7 ft-lbs. (7-10 Nm).

All line post sensors can be installed upright or in cantilever positions. However, VLS sensors are not mechanically designed to be used as insulators or busbar supports. The maximum cantilever load for each sensor is provided in section 1.4 below.
1.4 Instructions for use

1.4.1 VLS voltage sensors

VLS sensors are offered at 15 kV, 25 kV and 34.5 kV voltage classes as the VLS-110, VLS-150 and VLS-200, respectively. All VLS sensors measure voltage using resistive voltage divider technology and have a voltage output.

These sensors are designed to be used with IEDs which have 1 MOhm input impedance, however other impedances may be acceptable. It is recommended to check with your ABB sales representative or the factory for any sensor application.

VLS sensors are small, lightweight and easily mounted to a cross-arm or rack. Secure the VLS by using the 5/8"-11 bolt (not provided) through the cross-arm or rack and into the threaded insert on the bottom of the sensor, figure 6. The recommended torque for mounting is 50 ft-lbs. (5.8 Nm).

VLS sensors can be installed in a cantilever orientation, however they are not mechanically designed to be used as insulators or busbar supports. The maximum cantilever load to be applied to the primary terminal is 2 ft-lbs. (2.7Nm).

Connect the provided sensor cable to the built-in terminal at the base of the sensor. The proper connector matching the terminal is provided and connected to the cable.

Note that the other end of the sensor cable does not come with a connector and can be connected as necessary to the voltage monitoring device (relay, RTU, meter, etc.). Ensure the wire is connected properly at the device (the blue wire is voltage, V1 and the white wire is ground, V2).

Connect the sensor at the primary voltage side by tapping off the primary conductor and clamping the wire down in the primary clamp as displayed in figure 8. The recommended torque for this 3/8"-16 primary terminal stud is 12 ft-lbs. (16.2 Nm).

The minimum bend radius for all VLS secondary sensor cables is 4.5 inches with an operating temperature range of -40°C to +75°C.

1.4.2 VCS combination and VKS current sensors

VCS combination current and voltage sensors, as well as VKS current sensors, are available for the 15 kV voltage class as the VCS-110 and VKS-110 respectively. Both sensors provide voltage outputs for current and voltage measurement.

These sensors are designed to be used with IEDs which have 1 MOhm input impedance for voltage measurement and 1-10 MOhm for current measurement, however other impedances may be acceptable. It is recommended to check with your ABB sales representative or the factory for any sensor application.
10 Threaded inserts for VCS and VKS mounting and grounding

11 Proper installation of the primary conductor in VCS and VKS sensors

12 VCS and VKS secondary output connections

13 WLS and KLS sensor

The bottom of the unit contains four 1/2"-13 threaded mounting inserts as well as one centered 3/4"-10 threaded mounting insert for mounting the sensor to a cross-arm or rack. The recommended torque of the center mounting insert is 82 ft-lbs. (110 Nm). Either of the mounting hole configurations can be used to provide full support and grounding of the sensor.

These sensors can be used as a post insulator and have been tested to the post insulator standard ANSI C29.9-1983 (R2002/R2012). The maximum cantilever load is 2,800 ft-lbs. (3800Nm).

Isolate the primary distribution lines while mounting the VCS and VKS units. Remove the two primary cable clamps exposing the cable placement groove and lay the bare conductor into the groove. Conductor sizes can range from 0.2-1.0" (5.1-25.4mm). Replace the primary cable clamps into position and tighten bolts evenly to 26 ft-lbs. (35 Nm) as shown in figure 11.

Connect the provided sensor cable to the built-in terminal at the base of the sensor. The proper connector matching the terminal is provided and already connected to the cable.

Note that the other end of the sensor cable does not come with a connector and can be connected as necessary to the monitoring device (relay, RTU, meter, etc.). Ensure the wire is connected properly at the device (the red wire is current C1, black wire is current C2, blue wire is voltage V1, and white wire is ground V2).

The minimum bend radius for all VCS and VKS sensor cables is 3.8 inches with an operating temperature range of -20°C to +75°C.

1.4.3 WLS combination and KLS current sensors

WLS combination current and voltage sensors and KLS current sensors are offered for the 15 kV voltage class as the WLS-110 and KLS-110 respectively. Both sensors provide a current output for the current measurement and the WLS-110 provides a voltage output for voltage measurement.

These sensors are designed to be used with IEDs which have 1 MOhm input impedance for voltage measurement and 0.3 VA for current measurement, however other impedances may be acceptable. It is recommended to check with your ABB sales representative or the factory for any sensor application.

The bottom of the unit contains four 1/2"-13 threaded mounting inserts as well as one centered 3/4"-10 threaded mounting insert for mounting the sensor to a cross-arm or rack. The recommended torque of the center mounting insert is 82 ft-lbs. (110 Nm). Either of the mounting hole configurations can be used to provide full support and grounding of the sensor.
Threaded inserts for WLS and KLS mounting and grounding

WLS and KLS shorting clip. Shorted (top), unshorted (bottom)

Top of WLS and KLS sensor

Swing bolt loosened for opening the lid

Sensor with top lid open

Proper installation of the primary conductor in WLS and KLS

These sensors can be used as a post insulator and have been tested to the post insulator standard ANSI C29.9-1983 (R2002/R2012). The maximum cantilever load is 2,800 ft-lbs. (3800Nm).

Check that the unit is in the “shorting” position via the clip on the front of the unit. The sensor is shorted when the clip is attached to both screws.

Isolate the primary distribution lines while mounting the units, and then open one side of the top lid by loosening the nut and using the swing bolt. By using the swing bolt the lid does not need to be completely removed during installation.

Guide the primary connector into the groove and close the lid. Conductor sizes can range from 0.2-1.0" (5.1-25.4mm). Replace the top lid and torque the bolts to 4-6 ft-lbs. as shown in figure 18. Then replace the two primary cable clamps and torque the bolts to 26 ft-lbs. (35 Nm).

Connect the provided sensor cable to the built-in terminal at the base of the sensor. The proper connector matching the terminal is provided and already connected to the cable.
Note that the other end of the sensor cable does not come with a connector and can be connected as necessary to the monitoring device (relay, RTU, meter, etc.). Ensure the wire is connected properly at the device (the red wire is current C1, black wire is current C2, blue wire is voltage V1, and white wire is ground V2).

![Diagram of sensor connection]

After the mounting installation is complete and all connections are made, remove the switch from the shorting position, see figure 15.

The minimum bend radius for all WLS and KLS sensor cables is 5.0 inches with an operating temperature range of -40°C to +75°C.

1.5 Instructions for maintenance

Due to its hydrophobic properties and superior long-term resistance to tracking and erosion, HCEP is the industry leading insulation for outdoor environments. HCEP insulation minimizes the potential for flashovers, resulting in long-term performance, even in harsh coastal and industrial environments. Excessive dust or other kinds of pollution are usually self-cleaned, but if there is significant buildup, they must be cleaned off the sensor.

1.6 Transport and storage

The permissible transport and storage temperature for sensors is -50°C to +70°C.

1.7 Disposal of the sensor

The sensor does not contain environmentally hazardous materials. For disposal of the product after it has been taken out of use, local regulations, as appropriate, should be followed.