Guardian Pole and Conductor Sensor System

User Guide

Y21033-TUM
Revision A
www.Aclara.com

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1

SAFETY GUIDELINES & COMPLIANCE DECLARATIONS

Always consult and adhere to all local and national safety codes, regulations, and standards. WARNING, CAUTION and NOTE statements are used throughout this manual to emphasize important and critical information to help you ensure safety and prevent product damage. These statements are defined below.

Warning, Cautions, and Notes

⚠WARNING Indicates a potentially hazardous situation which, if not avoided, could result in death or serious physical injury hazard

⚠CAUTION Indicates a situation, which, if not avoided, could result in damage to equipment, damage to software, loss of data or invalid results.

NOTE Indicates important supplemental information.

The equipment will begin communicating once it powers up. This will expose people nearby to RF energy, however an analysis of the power levels finds that the levels are safe per FCC and Health Canada recommendations.

Users are advised to maintain a distance of 20 cm or more from the pole sensor or conductor sensor to minimize exposure levels.

Compliance Declarations

Pursuant to FCC 15.21 of the FCC rules, changes not expressly approved by Aclara Technologies LLC, might cause harmful interference, and void the FCC authorization to operate this product.

FCC/IC Compliance

This product complies with FCC & Industry Canada's RSS-102 radiation exposure limits set forth for an uncontrolled environment.

This device complies with Part 15 of the FCC Rules and Innovation, Science and Economic Development Canada license-exempt RSS standard(s). Operation is subject to the following two conditions: (1) This device may not cause harmful interference. and (2) this device must accept any interference received, including interference that may cause undesired operation.

Conformité FCC/IC

Ce produit est conforme à la norme FCC et aux limites d'exposition au rayonnement RSS-102 d'Industrie Canada définies pour un environnement non contrôlé.

Cet appareil est conforme à des règlements Innovation, Sciences et Développement économique Canada exempts de licence standard RSS (s). Son fonctionnement est soumis aux deux conditions suivantes: (1) Ce dispositif ne doit pas causer d'interférences nuisibles, et (2) cet appareil doit accepter toute interférence reçue, y compris les interférences pouvant entraîner un fonctionnement indésirable.

CHAPTER

2

INTRODUCTION

Pole and Conductor Sensor Overview

Hubbell/Aclara Guardian Pole and Conductor Sensors are installed on utility poles and power distribution conductors. They gather data about power conductor and utility pole temperature, position, and status. Conductor Sensors send data via Bluetooth® Low Energy (BLE) to a pole sensor, and the Pole Sensors collect and transmit all data via RF in the 450-470 MHz range to the Aclara Data Collector Unit (DCU) network. The DCUs send data and alarms to the headend server via a cellular, fiber, or ethernet backhaul, and the data is presented in AclaraONE for monitoring.

Conductor Sensors detect and monitor fault current and conductor drop/fall, and they communicate via BLE to the Pole Sensor with which they are paired during configuration. Conductor BLE health messages are sent every five seconds, and alarms are immediately sent for conditions such as:

- Drops
- Broken and fallen lines
- Fault currents beyond configurable ranges

The Pole Sensor gathers status messages and alarms from up to six Conductor Sensors on adjacent lines paired to it during configuration. It also detects temperature, pole impact, pole movement, or tilt, and can be used with or without Conductor Sensors. It communicates daily via STAR RF to DCUs its own health status along with that of any Conductor Sensors. The Pole Sensor sends alarms immediately for any changes beyond configurable limits within four custom tilt zones for conditions such as:

- Over temperature (pole fire)
- Tilts
- Falls
- Alarms received from Conductor Sensors

It uses BLE for Conductor Sensor messaging during normal operation, as well as communication with the Aclara Mobile Programmer for initial configuration.

Support

Aclara Connect

Aclara's customer portal (https://connect.aclara.com) enables you to access our frequently-updated knowledge database, easily access product documentation, submit and track your Support cases and RMAs, access Aclara University's Online Learning Center (OLC) and learning library, track your orders, join communities and groups, join in discussions with other Aclara customers and Aclara personnel, and much more. If you do not have access to Aclara Connect, email AclaraSupport@Hubbell.com and request access.

Aclara University

Aclara's on-demand training makes content available to you in a convenient, cost-effective online environment. The OLC has recordings of several webinars, streaming educational videos, software simulations, and short videos which walk you through a specific task. Access the OLC by going to Aclara Connect and clicking the Aclara University link.

Technical Support

Email AclaraSupport@Hubbell.com or call 1-800-892-9008 to speak with an Aclara representative.

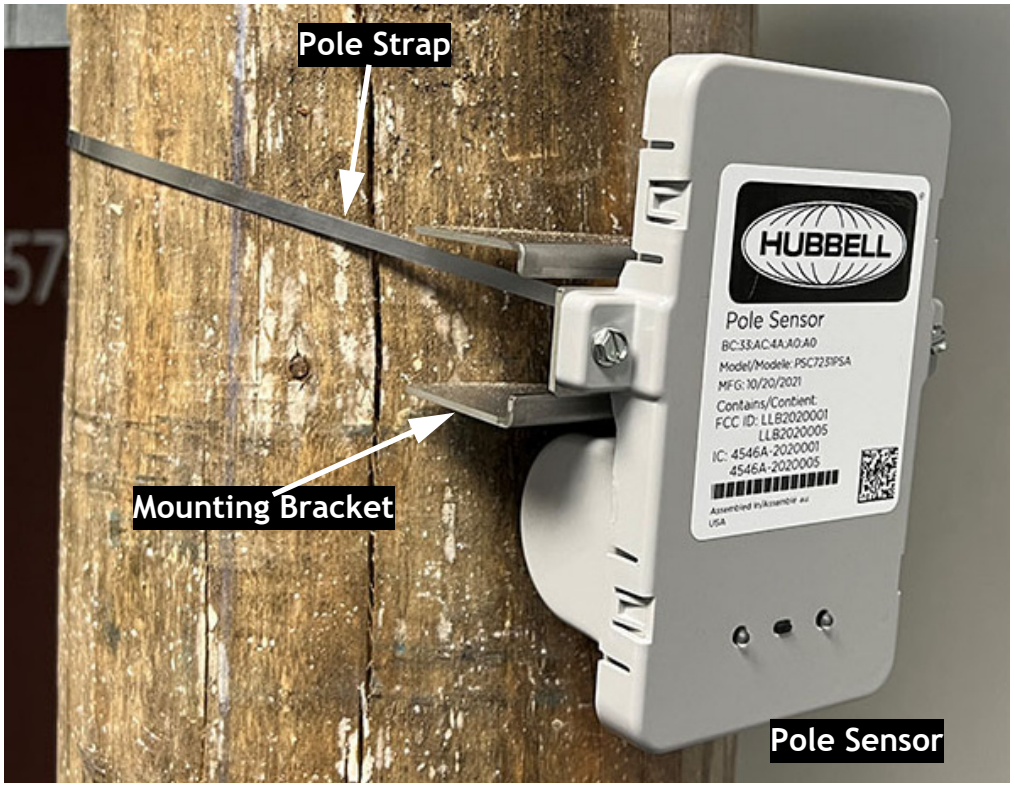
CHAPTER

3

SYSTEM COMPONENTS, SPECIFICATIONS, AND APPLICABLE STANDARDS

Pole Sensor (PN PSC7231PSA)

Figure 3.1 Pole Sensor Mounted on a Pole



The Pole Sensor is mounted to the utility pole and has the following functions:

- Identify pole tilt (This requires configuration via Mobile Programmer to set the various tilt limits and areas of concern.)
- Fire detection

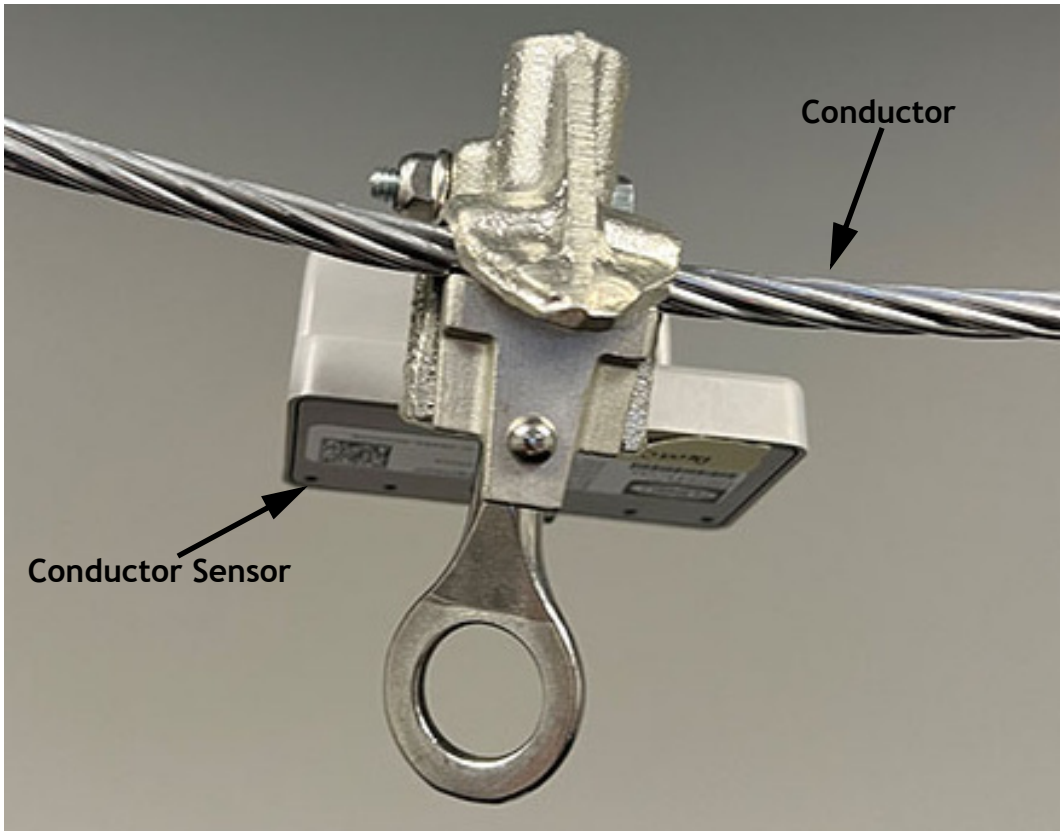
The Pole Sensor can be a stand-alone device, or it can connect with up to 6 Conductor Sensors for additional protection.

The Pole Sensor requires the following for mounting:

- Mounting Bracket
- Either pole strap or lag screw

Conductor Sensor (PN PSC7232CA)

Figure 3.2 Conductor Sensor Mounted on a Line



The Conductor Sensor is clamped directly to the Conductor using the integrated mounting clamp.

The Conductor Sensor has the following functions:

- Identify conductor drop/fall/break where the current-carrying conductor breaks and falls
- Fault current detection (This requires configuration via Mobile Programmer to set the fault current limit.)

Table 3.1 Product Specifications

Specification	Description
Pole Sensor External Enclosure	10% glass-filled polycarbonate
Conductor Sensor External Encolsure	10% glass-filled polycarbonate
Pole Sensor Dimensions (L x W x H)	2.7” x 4.31” x 4.6”
Conductor Sensor Dimensions (L x W x H)	3.90” x 3.40” x 4.46”
Pole Sensor Weight	.55lbs. +/- .05lbs.
Conductor Sensor Weight	.60lbs. +/- .05lbs.
Operating Frequency	450MHz to 470MHz Aclara STAR Network 2.402GHz to 2.480GHz Bluetooth Low Energy (BLE)
Operating Temperature	-40^{o}C - +85^{o}C
Storage Temperature	-40^{o}C - +85^{o}C
Operating Humidity	0% - 100% condensing
Antenna Connector	Built-in
RF Output	450MHz to 470MHz: 1W max (30dBm) 2.402GHz to 2.480GHz: 4.0mW max (6dBm)
Supported Protocol	Aclara STAR Network: 7232 Baud NRZ 2GFSK with +/-2.0KHz Dev Bluetooth Low Energy: 2Mbit/S GFSK
IP Rating	IP54

Table 3.2 Applicable Product Standards

Standard	Description
EMI/RF Standards	47 CFR Part 1 & 2 (Max Permissible Exposure for RF emissions) 47 CFR Part 15 (EMI\RFI Emissions) 47 CFR Part 90 (FCC Transmitter Cert) RSS-210 RSS-219 BLE IEC 61000-4-3 (EMI\RFI Susceptibility) IEC 61000-4-6 (EMI\RFI Susceptibility)
Electrical Safety Standards	IEC 61000-4-2 (ESD)
Environmental Standards	IEC 60068-2-2 (Operating & Storage Temp) IEC 60068-2-30 (Damp Heat Cycle - Relative Humidity MIL-STD-810F 503.4 (Thermal Shock) MIL-STD 810F (Altitude)
Mechanical Standards	IEC 60068-2-27 (Mechanical Shock) IEC 60068-2-6 (Mechanical Vibration) ISTA 1A (Transportation Shock & Vibration) IEC 62262 (Impact Resistance)
Additional Aclara Tests	Aclara Standard Mechanical Free Fall
Labeling Standards	49 CFR 173.185 for lithium battery marking 19 CFR 134.11 for country of origin marking

LEDs

The following sections describe the LEDs found on both the Pole Sensor and the Conductor Sensor.

Pole Sensor LEDs

Figure 3.3 Pole Sensor LEDs

Table 3.3 Pole Sensor LED Descriptions

LED	Behavior	Description
Green	Blinking for 5 seconds	Indicates the pole sensor is awake and ready to pair using the Aclara Mobile Programmer

Table 3.3 Pole Sensor LED Descriptions

LED	Behavior	Description
Green	Solid on for 5 seconds	Indicates the pole sensor is connected to the Aclara Mobile Programmer
Red	Solid on for 5 seconds	Indicates the pole sensor has detected a fault event

Conductor Sensor LEDs

Figure 3.4 Conductor Sensor LEDs

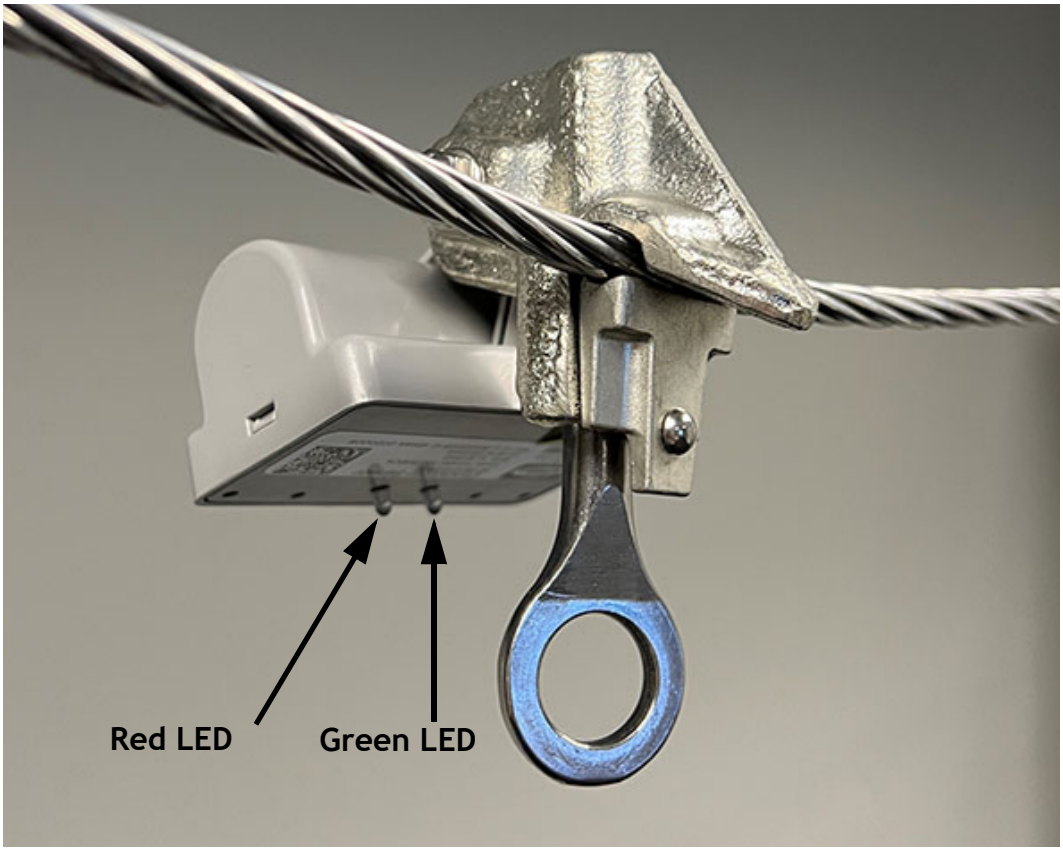


Table 3.4 Conductor Sensor LED Descriptions

LED	Behavior	Description
Green	Blinking for 5 seconds	Indicates the conductor sensor is awake and ready to pair with the pole sensor using the Aclara Mobile Programmer
Green	Solid on for 5 seconds	Indicates the sensor is connected to the Aclara Mobile Programmer
Red	Solid on for 5 seconds	Indicates the conductor sensor has detected a fault event

CHAPTER

4

INSTALLATION & CONFIGURATION

Field Calibration Procedure

Aclara Technologies LLC low power RF devices have passed through extensive testing and calibration procedures while in the factory. Therefore, no additional calibration or adjustment is required in the field.

Tools, Materials, and Equipment Required

- Pole Sensor
- Pole Sensor mounting bracket
- Magnet of at least 20mT in strength
- Stainless steel cable tie long enough to go around the circumference of the pole and bracket
- Cable tie tool
- Cordless drill equipped with a 1/4” hex bit
- Conductor Sensor(s) - optional
  - Hot stick (Chance C4030291 or equivalent)
- Bluetooth®-enabled programming device (iOS or Android® phone or tablet or Windows® 10 tablet or laptop) with Aclara Mobile Programmer application
- Lift truck

NOTES Installation should be performed by a qualified powerline technician.

The Pole Sensor may be mounted to wooden utility poles with diameters ranging from 6" to 12", or on a metal lattice type structure.

Use a magnet (strength of 20mT or greater) to wake up the sensors you wish to install.

Mount the Pole Sensor vertically on the side of the pole as near the top of the pole as allowable, 40" or more from the power lines.

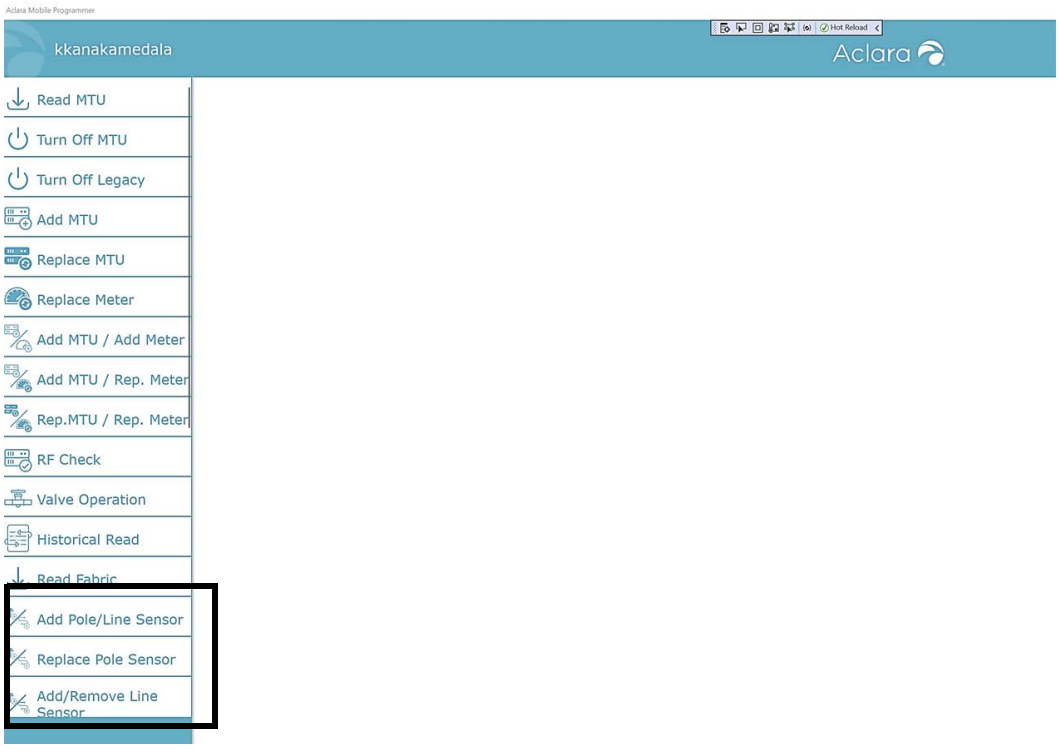
Mount the Pole Sensor with the front face of the sensor parallel to the power lines.

Mount the Pole Sensor on the side opposite guy wires.

Configuration

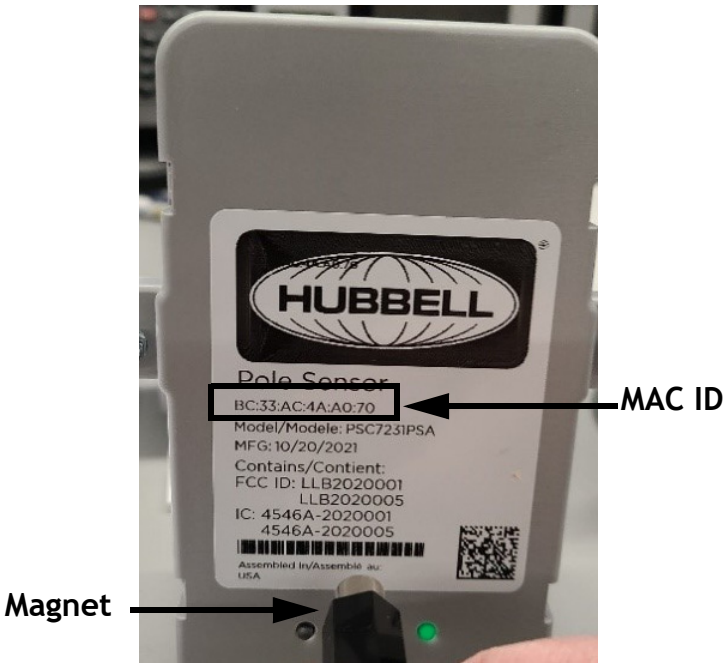
Some configuration is required prior to installation. Launch the Mobile Programmer application and enter login credentials to view the landing page. If necessary, enter configuration credentials to download .xml files. (See the *Mobile Programmer User Guide, Y21009-TUM*.)

Initial configuration should be done on the ground as data collection involves moving around the pole.



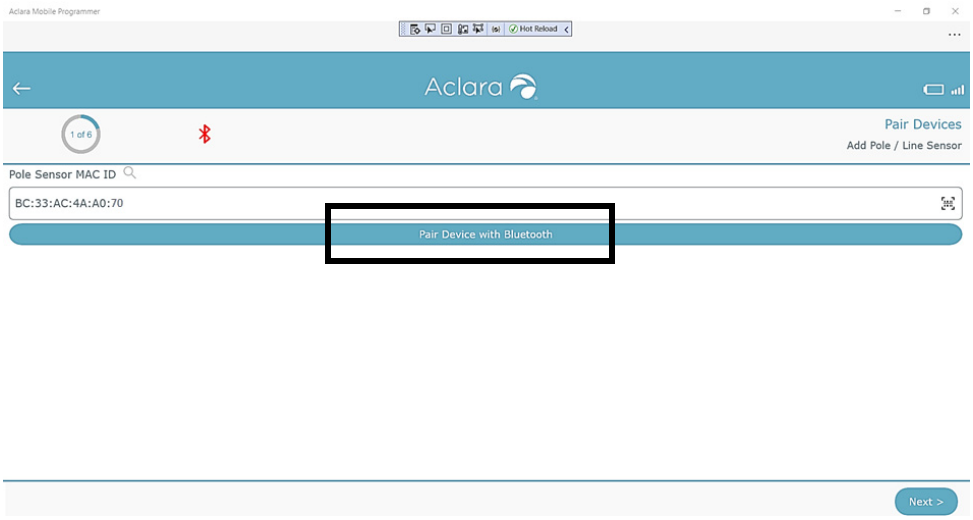
Use the following procedure to configure the Pole Sensor and Conductor Sensor.

1. Use a magnet of 20mT or greater to wake up the Pole Sensor by placing the magnet above the temperature sensor between the LEDs until the green LED begins to blink. The LED will blink for five seconds.



   You will have 5 minutes to pair the device.

2. On the main menu, tap the **Add Pole/Line Sensor** button.
3. Enter the MAC ID of the Pole Sensor (found on the sensor label) by typing, or use the scan icon in the right of the entry field to scan the label 2D bar code.



4. Then tap the **Pair the Device with Bluetooth** button.

Once the Pole Sensor is paired, the Bluetooth icon will change from red to green. Select the Number of Conductor Sensors to be used at this pole. There will be only one conductor sensor per line. The Conductor Sensor data entry field appears.

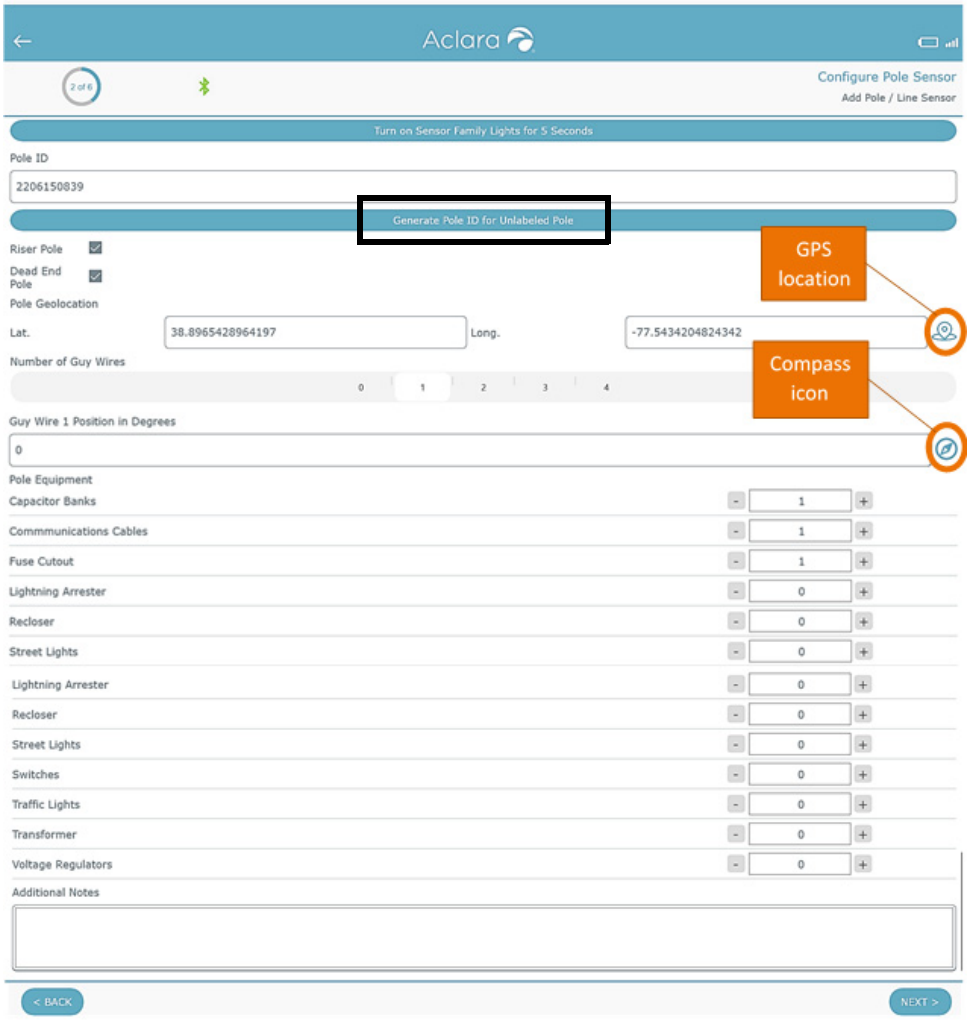
5. Conductor Sensors are optional. If they are to be used at the pole, use a magnet with a strength of 20mT or greater to wake up any Conductor Sensors. Hold the magnet for three seconds between the LEDs. The green LED will light and blink for five seconds.

6. Enter or scan the first Conductor Sensor MAC ID. If pairing is unsuccessful, use magnet to put the sensor back in pairing mode, then repeat.

7. Once all the sensor MAC IDs are entered, tap the **Turn on Sensor Family Lights for 5 Seconds** button. Verify that the LEDs on the Pole Sensor and any Conductor Sensors light.

8. Tap the **Next** button in the bottom right.

9. The Collect Pole Information screen will now display. On this screen, enter the Pole ID as well as information for any devices on the pole. You will need to scroll down to see the full page.



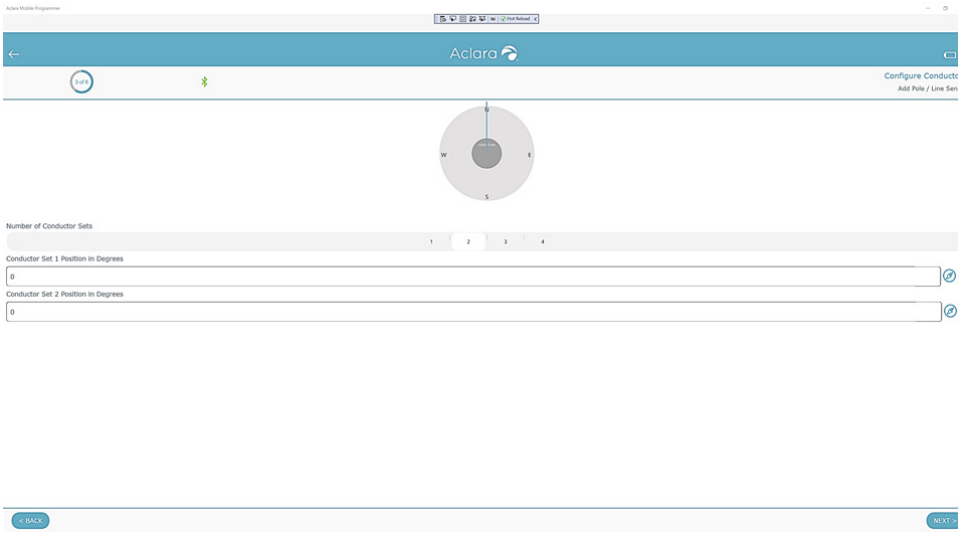
10. Enter the Pole ID. If the pole has no label indicating its ID, tap the **Generate Pole ID for Unlabeled Pole** button and the application will generate a number. This generated number can be edited by the user as necessary.
11. Select the check boxes for Riser Pole and/or Dead End Pole if they apply.
12. Tap the icon to collect the GPS location. The latitude and longitude coordinates will auto-populate.
13. Select the number of guy wires. For each guy wire, enter the Position in Degrees. To determine the position, stand with back to pole directly under guy wire, facing its ground anchor point and tap the **Compass** icon while holding the mobile device parallel to the ground and pointing to the ground anchor.
14. For each type of equipment on the pole, select the number of pieces by using the + or - buttons. The default value for each is 0.

15. Once all equipment is defined, tap the **Next** button in the bottom right.
16. The Configure Conductor(s) Information Screen will now display. This screen allows you to enter where the conductor(s) enter and exit the pole. The number of Conductor Sensors displayed will match what was entered in the Pair Devices screen previously. Be sure you have identified which Conductor Sensor will be installed on each line and enter the position in degrees. Use the following procedure to determine the position.
    1. Stand with your back against the utility pole.

    2. Maneuver around the pole until the conductor set you wish to add is directly overhead.

3 Hold the handheld device level to the ground and point it in the direction the conductor set is traveling away from the pole.

4 Tap the **Compass** icon and the handheld device compass reading will indicate the direction from the pole that the conductor set is headed away from the pole.



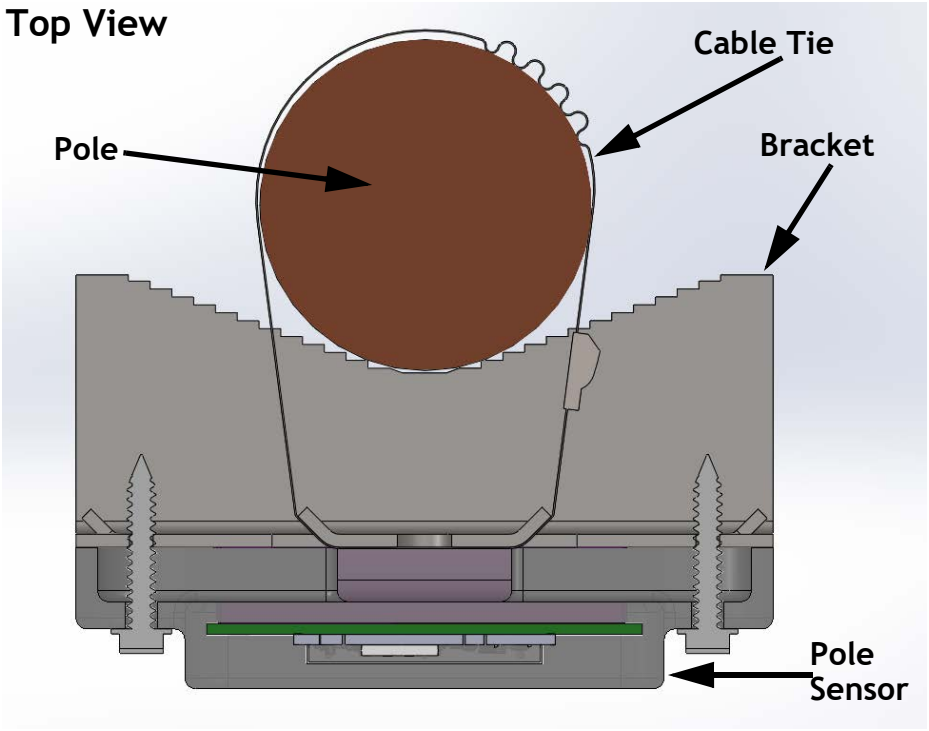
Once the devices have been paired and the data entered, tap the **Next** button to install the Pole and Conductor Sensors.

You are now ready to work in the bucket of the lift truck. You will need the Pole Sensor, any Conductor Sensors, the programming device, and all the tools listed.

Pole Sensor Installation

⚠WARNING Use the following procedure for installing a pole sensor. Follow your company's guidelines when performing this installation.Wear appropriate PPE, such as gloves, eye protection, etc. Follow all applicable safety guidelines.

1. Install the sensor at least 40" from power lines. The serrated angled surfaces of the bracket will be the back of the bracket and will be installed in contact with the pole, and the plate with the screw holes will be the front.



2. Insert the end of the stainless steel cable tie from the back through one slot in the bracket and then back through the second slot.
3. Wrap the cable tie around the pole, positioning the bracket on the side of the pole opposite guy wires. Insert the free end of the cable tie through the locking head end and pull hand tight.
4. Insert the end of the tie into the cable tie tool and tighten. Insert the free end of the cable tie into the cutting slot of the tool and trim, taking care to catch the off-cut to prevent it falling and causing injury.
5. Place the Pole Sensor against the face of the bracket with the label upright and align the screw holes with the matching holes in the bracket. Insert screws and tighten with a cordless drill and a 1/4" hex bit.

Conductor Sensor Installation (Optional)

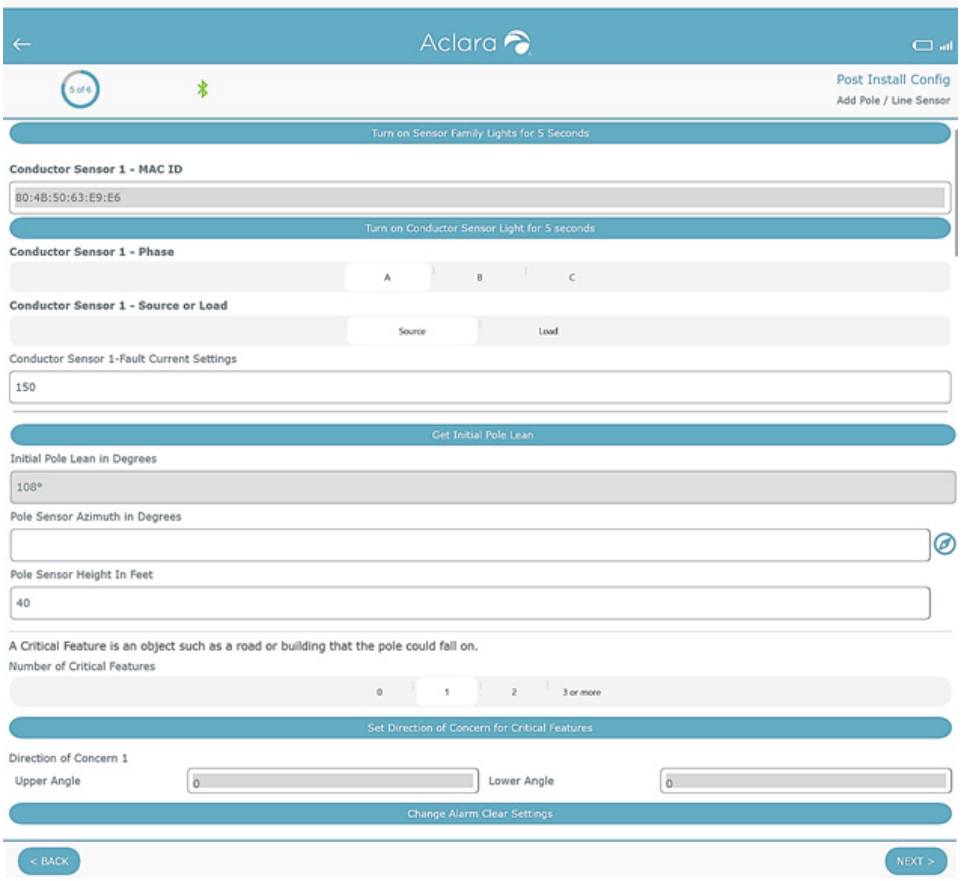
⚠WARNING Use the following procedure for installing a pole sensor. Follow your company's guidelines when performing this installation.Wear appropriate PPE, such as gloves, eye protection, etc. Follow all applicable safety guidelines.

1. If conductor sensors are being used on the pole, open the sensor completely by turning the eye bolt counterclockwise until there is resistance to turning it. Attach the eye bolt of the sensor to end of the "shotgun" type hot stick. Once secured, position the unit so that the conductor seats into the canal of the unit with the eye bolt pointing straight down such that the LEDs can be seen from the ground. Turn the eye bolt clockwise to close the unit. You may feel vibration as it closes on lines with high current. Torque the eye bolt to 3.5 to 4.0 ft-lbs.
2. Install any other Conductor Sensors paired with the Pole Sensor in the same manner.

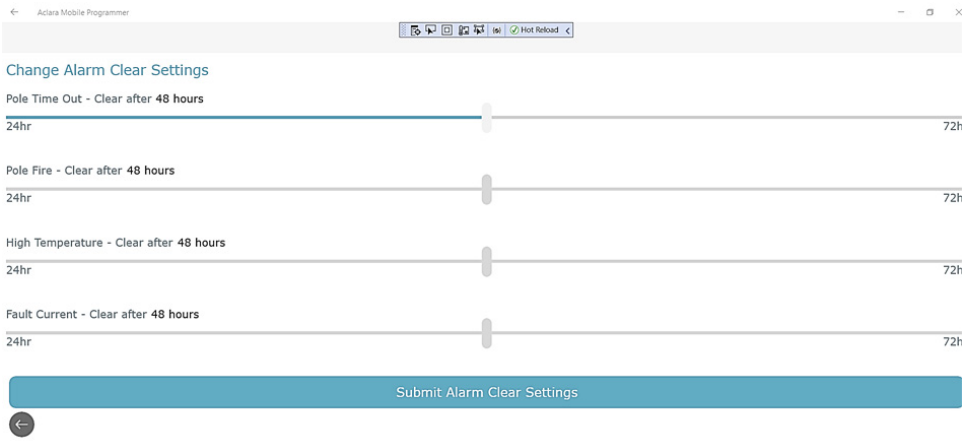
Configuration Completion

1. The Post Install Conductor Sensor(s) Config screen will display. There will be 1 of these screens for every Conductor Sensor installed.
2. Select the Phase and Source or Load for each conductor, and enter the Fault Current Setting.
3. Tap the **Get Initial Pole Lean** button to gather the angle.
4. Pole Sensor Azimuth in Degrees is the angle of direction of the lean. As when determining the angles of the conductors, put your back to the pole on the side it leans toward, and tap the **Compass** icon to collect the angle.
5. Enter the Pole Sensor Height in feet.

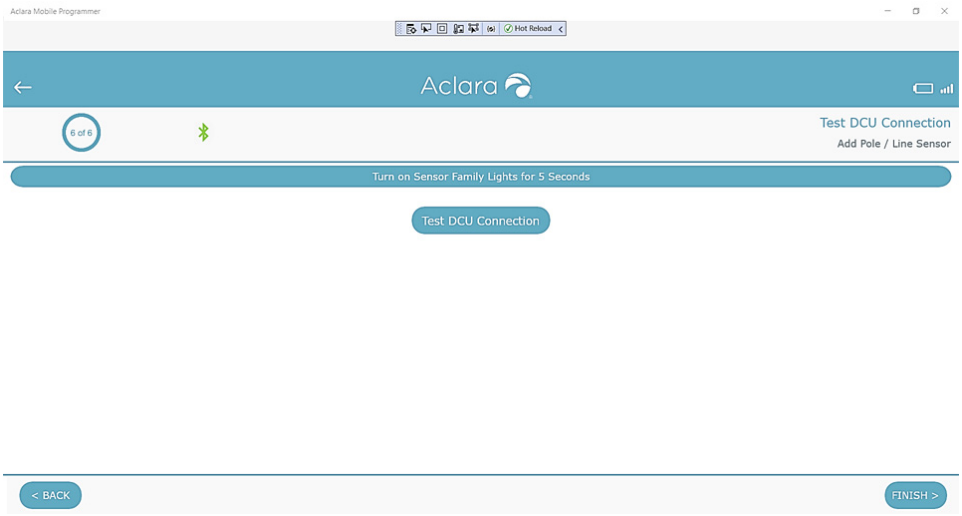
6. Enter the number of critical features up to 2. As described on the screen, a critical feature is an object such as a road or building that the pole could fall on. Use the compass to determine the upper and lower angle for each feature.



7. Tap the **Change Alarm Settings** button.



8. Use the slider to set the number of hours after which to clear the alarm. Set the clear time for Time Out, Pole Fire, High Temperature, and Fault Current Alarms.
9. Tap the **Submit Alarm Clear Setting**s button.
10. The Test DCU Connection screen will display after all configurations have been set.



This function allows you to verify that the Pole Sensor is able to communicate with at least one DCU. When you tap the **Test DCU Connection** button, the application will send a ping from the Pole Sensor to the DCU network and return a result within 3-5 minutes indicating success or failure.

APPENDIX

A

ALARMS

The alarms generated by the Guardian Pole and Conductor Sensor System will be viewable through AclaraONE headend. The tables below provide a brief description of the both the Pole Sensor and Conductor Sensor alarms.

Pole Sensor Alarms

The following table provides a brief description of the Pole Sensor alarms:

Alarm	Description
Pole Impact	This alarm is sent immediately upon detection of an impact event.
Pole Tilt	This alarm is sent as soon as pole tilt is detected.
Pole Fire	This alarm is sent as soon as the temperature trend is >= 1°C per second.
Pole Sensor Over Temperature	This alarm is sent as soon as the temperature is > 80°C.
Pole Sensor Low Battery	This alarm is sent as soon as the battery has reached a low battery state.
Pole Sensor Last Gasp	This alarm is sent once the energy consumption from the battery has reached the end of its useful life.
Pole Sensor Out of Memory	This alarm indicates the record count has reached maximum.
Pole Sensor Bluetooth Low Energy Connection	This alarm is sent if a connection to a paired Conductor Sensor is lost and not reestablished within 5 minutes.

Line Conductor Sensor Alarms

The following table describes the Conductor Sensor alarms:

Alarm	Description
Conductor Drop	This alarm is sent immediately upon detection of the conductor dropping.
Conductor Fault Current	This alarm is sent as soon as unintended, uncontrolled high current flow is detected on the line.
Conductor Sensor Over Temperature	This alarm is sent once the sensor is >80˚C for 10 seconds.
Conductor Sensor Low Battery	This alarm is sent once the battery has reached the end of its life, which means the battery has approximately one month of usage remaining.

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