

GridAdvisor™ Series II smart sensor installation instructions



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Cover Photo: GridAdvisor series II smart sensor

Safety for life

Eaton meets or exceeds all applicable industry standards relating to product safety in its products. We actively promote safe practices in the use and maintenance of our products through our service literature, instructional training programs, and the continuous efforts of all Eaton's employees involved in product design, manufacture, marketing, and service.

We strongly urge that you always follow all locally approved safety procedures and safety instructions when working around high voltage lines and equipment and support our *Safety For Life* mission.

Safety information

The instructions in this manual are not intended as a substitute for proper training or adequate experience in the safe installation, operation, servicing and testing of the equipment described. Only competent technicians who are familiar with this equipment and these instructions should install, operate, service and test it.

A competent technician has qualifications including:

- Is thoroughly familiar with these instructions and equipment.
- Is trained in industry-accepted high- and low-voltage safe operating practices and procedures.
- Is trained in the care and use of protective equipment such as arc flash clothing, safety glasses, face shield, hard hat, rubber gloves, clampstick, hotstick, etc.

Following is important safety information. For safe installation and operation of this equipment, read and follow all cautions and instructions.

Hazard Statement Definitions

This manual may contain four types of hazard statements:

DANGER

Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or equipment damage.

NOTICE

Indicates a hazardous situation which, if not avoided, may result in equipment damage only.

Safety instructions

Following are general caution and warning statements that apply to this equipment. Additional statements, related to specific tasks and procedures, are located throughout the document.

DANGER

Hazardous voltages are present.

Death, personal injury and equipment damage, can result if safety precautions are not followed.

Use authorized utility safety procedures to install, test, and service the GridAdvisor series II smart sensor.

WARNING

Before installing, operating, maintaining, or testing this equipment, carefully read and understand the contents of this document.

Improper operation, handling, or maintenance can result in death, severe personal injury and equipment damage.

WARNING

This equipment is not intended to protect human life.

Follow all locally approved procedures and safety practices when installing or operating this equipment.

Failure to comply may result in death, severe personal injury and equipment damage.

Introduction

The GridAdvisor™ Series II smart sensor helps utilities improve the efficiency in which they operate their distribution systems by improving outage management, capacitor bank maintenance and providing critical system information not previously available. This simple yet sophisticated product can announce directional fault targeting, detect capacitor bank fuse failure and provide a DNP3 scannable line monitoring device at nearly any location.

The ProView® NXG configuration software allows a single stocked item to be used for many different applications. The smart sensors meet or exceed IEEE Std 495™-2007 standard “Guide for Testing Faulted Circuit Indicators” making them suitable for underground applications.

The GridAdvisor Series II smart sensor saves both operation and maintenance dollars by reducing drive time, and maximizes energy dollars by keeping capacitors online, operating at peak efficiency. Being hotstick installable with no additional hardware or back office software needed, this is the easiest way to gain SCADA visibility across the power distribution network.

Note: This document applies to product serial numbers that contain 12 characters hexadecimal formatting.

Read this manual first

Read and understand the contents of this manual and follow all locally approved procedures and safety practices before installing or operating this equipment.

Additional information

These instructions cannot cover all details or variations in the equipment, procedures, or process described, nor to provide directions for meeting every possible contingency during installation, operation, or maintenance. For additional information, contact your Eaton representative.

Acceptance and initial inspection

Receiving inspection

Each sensor is in good condition when accepted by the carrier for shipment. Upon receipt, inspect the shipping container for signs of damage. Unpack the sensor and inspect it thoroughly for damage incurred during shipment. If damage is discovered, file a claim with the carrier immediately.

Handling

Be careful during handling and storage of the sensor to minimize the possibility of damage. If the sensor is to be stored for any length of time prior to installation, provide a clean, dry storage area.

Quality standards

ISO 9001 certified quality management system

Installation procedures

SIM cards

A SIM card is a small removable card consisting of an embedded SIM chip. The SIM card is inserted into the sensor to provide the required authentication for the sensor to connect to the cellular network associated with the SIM card.

If the sensor will be communicating over a CDMA network, no SIM card is required. Verizon® is an example of a cellular provider using CDMA technology.

GSM cellular SIM card

Smart sensors that communicate over a GSM cellular network will require the proper Subscriber Identity Module (SIM) card.

Rogers™ is one example of a cellular provider using a GSM network technology.

4 G LTE SIM card

All the smart sensors that communicate over 4G LTE cellular networks will require the proper SIM card.

The following networks use a SIM card to connect with the 4G LTE cellular network:

- AT&T®
- Verizon
- Telus
- Bell Canada

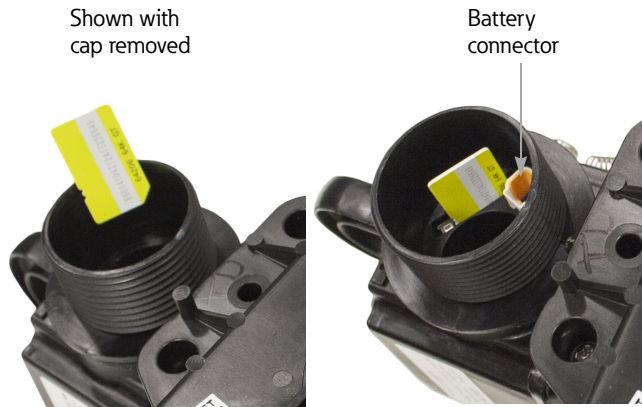
Installing the SIM card

Inside the battery compartment is a small slot on the inside wall for inserting the SIM card (Figure 1 on page 5). This slot is commonly referred to as a “push-push” receiver. Putting slight finger pressure on the card will cause it to snap into place. If inserted properly you will hear a click when the SIM card is properly seated. Pushing the engaged SIM card again will cause it to slightly depress with a click and then eject for removal. Putting SIM card into receiver with wrong orientation and applying strong pressure may cause damage to sensor and/or SIM Card, please review instructions for installation.

1. Remove sensor barrel cap to access battery compartment. Take care not to lose the gasket located on inside of cover.
2. Locate SIM Card Slot on side wall inside sensor shown in Figure 1 on page 5.
3. With metal strips of SIM card facing outside of barrel and the chamfered edge of the SIM card facing downward, push SIM card into place. SIM card should remain depressed and click into place if properly installed.
4. Re-tighten cap from 17-22 in-lbs of torque to prevent any water ingress.

In cases where a torque wrench is not available; tighten the cap until the gasket inside the cap makes contact with the battery, turn another 1/2 turn to ensure proper tightening.

Figure 1. Battery and SIM card locations



Forcing over the air service provision (OTASP) (Verizon 3G only)

If the cellular provider being utilized with GridAdvisor Series II smart sensor does not require use of a SIM card as is case with the Verizon network, the user must initiate an OTASP (over the air service provision).

This specific action will cause the sensor to actively interrogate the network for a proper IP address from which the device was activated. Failure to complete this step will result in communication failures generally visualized on the sensor as simultaneous red blinking LEDs.

Note: A Binary Output control point can be set by the SCADA system to trigger an OTASP sequence that is delayed by 5 minutes to allow time for the new radio provisioning to be setup by Verizon.

1. Ensure that device is powered up and has completed initialization as indicated by double green blinking LEDs.
2. Reed switch device by placing a strong earth metal magnet next to the device as indicated by the symbol "R" found on the rear side corner of the upper housing opposite of LEDs.
3. Reed switch will initiate Bluetooth® discovery mode, but in order for OTASP to complete the sensor must not be paired with. After a two minute timeout, the sensor will connect to network and receive proper IP address and preferred roaming list.
4. Alternatively, if the device is Bluetooth® paired and connected to ProView NXG software, the sensor will complete OTASP upon disconnect of ProView NXG software.
5. OTASP may take up to five (5) minutes, with included retries, so do not the remove battery from the sensor within this time frame.
6. OTASP results can be confirmed in the sensor's communication logs with the ProView NXG software.

Note: If the OTASP process fails and the sensor blinks red LEDs continuously, check the communication log for diagnostics. OTASP can fail if sensor is on roaming network or has poor signal strength.

Installing battery

1. Remove sensor barrel cap to access battery compartment. Take care not to lose the gasket located on inside of cover.
2. Locate battery inside sensor and battery connector on side wall inside sensor shown in Figure 1.
3. Battery and sensor connectors are keyed to prevent misalignment. Press connectors together until they snap into locking position.
4. Device will begin initialization and attempt cellular activation.

CAUTION

Leaving sensor activated without proper charging current source will lead to equipment (battery) damage.

5. Re-tighten cap from 17-22 in-lbs of torque to prevent any water ingress.

In cases where a torque wrench is not available; tighten the cap until the gasket inside the cap makes contact with the battery, turn another 1/2 turn to ensure proper tightening.

Shelf mode

As an alternative to disconnecting the battery for prolonged time without a proper charging source, the sensor can be commanded into "Shelf Mode". This is accomplished via an active connection with ProView NXG using the **Operate → Control Operation dialog**, or by sending a DNP3 binary output control command via the SCADA connection to binary output index 08.

To return the sensor to normal operation from Shelf Mode, perform a reed switch with a magnetic reset tool. The device will then initialize in the same manner as when installing the battery. There is no way to remotely force this action, so ensure the device initializes before leaving the site.

Underground distribution circuits

Primary cable preparation

Proper primary cable preparation is necessary for the GridAdvisor Series II smart sensor acting as a faulted circuit indicator to work reliably on underground distribution circuits. The sensor can be used on concentric neutral, tape shield, or drain wire cable. If the cable does not provide a return path for the fault current, the sensor can be installed directly over the cable. If used on concentric neutral cable, or if the cable shield provides a return path for the fault current, the sensor will not reliably detect a fault and will require the use of a tape shield or drain wire adapter. When used, the adapter must be installed approximately 3.5 inches below the elbow to allow space for mounting the sensor on the cable.

One of the following four methods is preferred for installation on concentric neutral primary cable:

Method 1 (refer to Figure 2A)

1. Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.
2. Terminate all of the remaining neutral wires approximately 6 inches below the elbow.
3. Pull the neutral wires straight up and terminate them again just below the elbow. The wires should then be bent back down the cable (commonly referred to as “double back”).
4. Terminate the ground wires approximately 6 inches below the elbow.

Note: The sensor is installed over the “double back” neutral wires to cancel the effect of current in the neutral. The exact trip value is dependent on the overall diameter of the “double back” neutral wires.

Method 2 (refer to Figure 2B)

1. Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.
2. Terminate all of the remaining neutral wires just below the elbow. The balance of the neutral wires should be gathered together and “double backed” down the cable and grounded.
3. The sensor is installed over the “double back” neutral wires to cancel the effect of current in the neutral. The exact trip value is dependent on the overall diameter of the “double back” neutral wires.

Method 3 (refer to Figure 2C)

1. Attach one or two strands of the concentric neutral wrapped around the cable to the tie-off tab on the elbow.
2. Terminate and ground all of the remaining neutral wires approximately 6 inches below the elbow.

Method 4 (refer to Figure 2D)

1. Arch one or two strands of the concentric neutral wrapped around the cable and attach it to the tie-off tab on the elbow.
2. Ensure that the arch is large enough to go around the outside sensor when the sensor is installed.

In some installations, improper preparation of the primary cable will result in an inoperable sensor as a faulted circuit indicator (FCI) (Figure 3). The magnetic field, due to current in the center conductor, will be canceled by the current in the concentric neutral wires.

CAUTION

Do not place the fault indicator as shown in Figure 3. Doing so will prevent the sensor from working properly.

Figure 2. Recommended methods of concentric neutral primary cable preparation

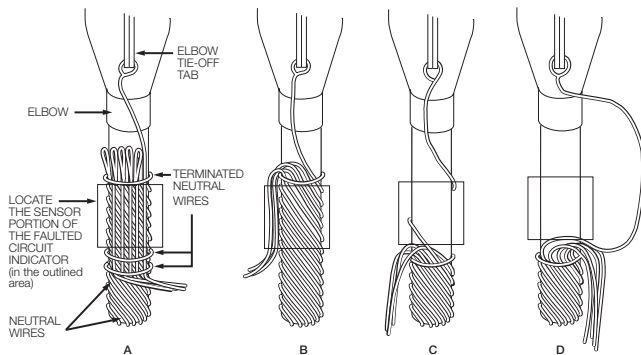


Figure 3. Incorrect methods of concentric neutral primary cable preparation

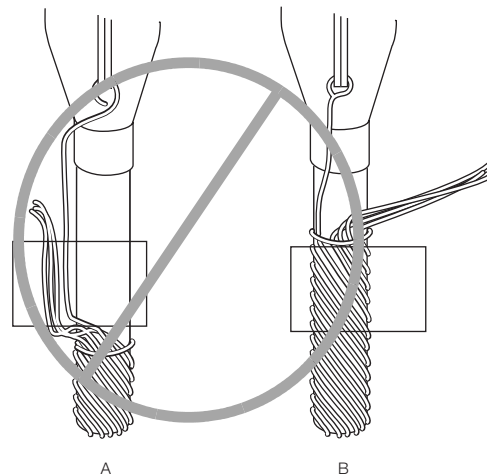
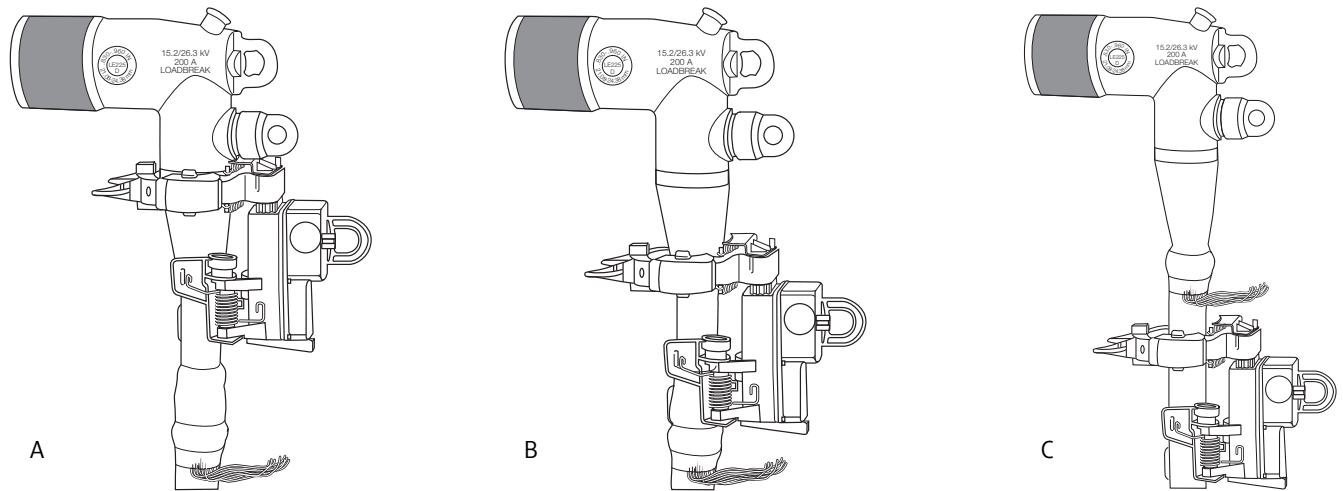


Figure 4. Figures A and B show proper installation of smart sensor on prepared conductor. Figure C shows incorrect placement for installation.



Installation of smart sensor – underground application

1. Arm the sensor clamping mechanism by carefully grasping both clamping arms, pulling them apart until the trigger mechanism drops into place. Stops have been built into the clamping arms such that they can only be opened to the point where the trigger will latch (Figure 5).
2. For applications where the cable diameter is less than 1 inch leave the clamp pads attached to the clamp arms. On installations where the cable diameter exceeds 1 inch, remove the pads that are attached to each clamping arm. Removing the pads will allow the clamping mechanism to properly attach to larger diameter cables (Figure 6).
3. Attach the sensor to a hotstick using the pulling eye.
4. Push the sensor onto the cable below the elbow at a location shown in Figure 4 while holding the hotstick horizontal. The triggering mechanism will release the clamping arms and securely attach the device to the cable.

Note: Only the closed core current transformer (CT) need be applied over the region of the cable where the concentric neutral has been removed or double-backed (Figure 5).

For installation on tape shield cable, the closed-core CT of the sensor should be placed above the location on the cable where the tape shield has been removed or trained back as part of the cable termination. Location of the sensor must be similar to Figure 2 on page 6 (C or D), or Figure 4 (A or B), for proper operation of the sensor as an FCI.

5. Remove the hotstick.

Note: On 200 A load-break elbows, the preferred installation is demonstrated in Figure 4 (A), where the closed core CT is located directly below the test point.

Figure 5. Smart Sensor clamping arms in the latched position.

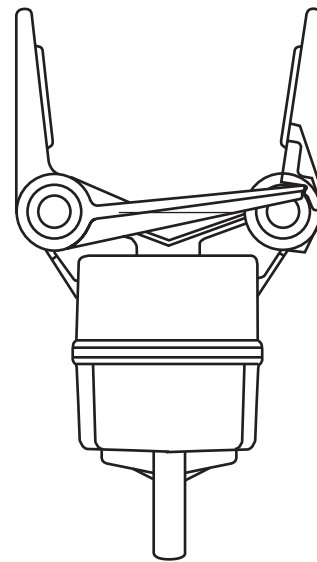


Figure 6. Remove clamp pads attached to each clamping arm on a mechanism where cable diameter exceeds 1".

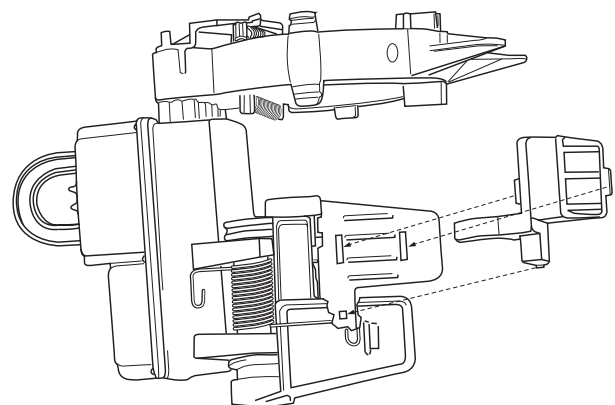
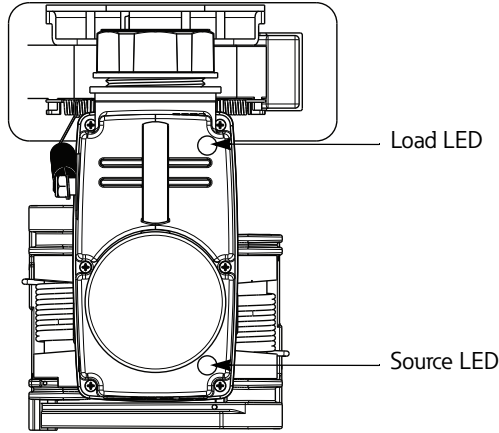


Figure 7. Smart Sensor LED designations.



Installation of smart sensor – overhead application



Install the sensor a minimum of ten (10) feet away from any structure on the conductor, including any poles.

1. Arm the FCI clamping mechanism by carefully grasping both clamping arms, pulling them apart until the trigger mechanism drops into place. Stops have been built into the clamping arms such that they can only be opened to the point where the trigger will latch (Figure 5 on page 7).
2. For applications where the cable diameter is less than 1 inch, leave the clamp pads attached to the clamp arms. On installations where the cable diameter exceeds 1 inch, remove the pads that are attached to each clamping arm. Removing the pads will allow the clamping mechanism to properly attach to larger diameter cables (Figure 4 on page 7, Figure 6 on page 7).
3. Attach the sensor to a hotstick using the pulling eye.
4. Push the sensor onto the cable conductor. Ensure that the CT is around the conductor and good contact is made between the ends of the CT. The triggering mechanism will release the clamping arms from the latched position, to securely attach the device to the cable.

Table 2. LED annunciation during cellular activation

Sequence steps (in order)	Source LED	Load LED
Initialization	A single pulse green LED. Bluetooth® and cellular modules are unavailable and device will not respond to reed switch.	A single pulse green LED. Bluetooth® and cellular modules are unavailable and device will not respond to reed switch.
Initialization Failure	LED will blink red continuously. Contact Factory for assistance after attempting to force an OTASP or inserting a new SIM card.	LED will blink red continuously. Contact Factory for assistance after attempting to force an OTASP or inserting a new SIM card.
Initialization Complete	A double pulse green LED. Bluetooth® module is available for programming sensor by reed switching device.	A double pulse green LED. Bluetooth® module is available for programming sensor by reed switching device.
Successful Cellular Activation	Three yellow LED flashes in succession ten times. Indicates sensor has received IP address from network.	Three yellow LED flashes in succession ten times. Indicates sensor has received IP address from network.
Failed Cellular Activation	Three (3) red LED flashes in succession ten (10) times. Contact utility network administrator to verify proper configuration of cellular account.	Three (3) red LED flashes in succession ten (10) times. Contact utility network administrator to verify proper configuration of cellular account.

Sensor display operation

The GridAdvisor Series II smart sensor has two multicolor light emitting diodes (LEDs) used for annunciating functional tasks and the status of the smart sensor. Each LED will be referred to as Source and Load LED in the context of the labels found on sensor per Figure 7.

Note: The fault LEDs can be disabled in the sensor configuration.

Device activation

The LEDs provided on the GridAdvisor Series II smart sensor provide annunciation during the activation process of the sensor onto the cellular or Bluetooth SCADA network at time the battery is installed; see Table 2 and Table 3.

LED installation indication

The LEDs provided on the GridAdvisor Series II smart sensor provide annunciation during the installation of device to verify proper load current is present.

Table 1. GridAdvisor Series II Smart Sensor LEDs Provided

Sequence Steps (in order)	Source LED	Load LED
Current present below 10 Amps	RED Moving Bar Sequence for Direction	RED Moving Bar Sequence for Direction
Current present below 50 Amps	AMBER Moving Bar Sequence for Direction	AMBER Moving Bar Sequence for Direction
Current present above 50 Amps	Green Moving Bar Sequence for Direction	Green Moving Bar Sequence for Direction

Programming sensor

Refer to the *GridAdvisor Series II Smart Sensor ProView NXG software programming manual (MN915003EN)* for instructions on connecting to the sensor with the Bluetooth® module and/or programming device with ProView NXG software.

Reed switch functionality

The smart sensor's internal Reed switch and a magnet are used to trigger the following functions:

- Bluetooth functionality
- Over-the-air (OTA) commissioning
- Factory reset

The primary selection of the menu occurs when the first valid Reed switch operation is detected. Once this is detected, the cell radio is shutdown.

During shutdown, the LEDs will do a very fast blue blink, after that a 10 second window is opened and the LEDs flash the color associated with a menu option.

If another valid switch is detected the next menu item is displayed. If a switch is *not* detected, the lights will go solid indicating that a selection was made.

Once the reed switch is activated, the actions detailed in Table 3 occur.

Table 3. Reed switch function sequencing

Sequence steps	Action	LED Behavior
First reed switch activation	After 10 seconds, if no further reed switch closure occurred, the Bluetooth radio will be turned on, enter discoverable mode and wait for a connection.	Load and Source LEDs will flash a simultaneous blue sequence. After 10 seconds, the Load and Source LEDs will light solid for 2 seconds indicating that Bluetooth functionality is active. You may now initiate Bluetooth pairing.
Second reed switch activation	After 10 seconds, if no further reed switch closure occurred, a request to run OTASP on the next modem power up will be selected.	Load and Source LEDs will flash a simultaneous yellow sequence.
Third reed switch activation	After 10 seconds, if no further reed switch closure occurred, the option to reset the sensor to factory default settings is selected and the sensor will wait another 10 seconds for an additional, fourth activation to confirm the factory reset. Note: This is the only reed switch selection that must be confirmed with an additional reed switch activation to initiate the factory reset.	Load and Source LEDs will flash a simultaneous red sequence. Load and Source LEDs will flash a simultaneous <i>fast</i> red sequence while waiting for the factory reset confirmation. Upon confirmation, the Load and Source LEDs will light solid for 2 seconds and the factory reset occurs.
Fourth reed switch activation	No action is taken and the sensor exits the reed switch menu.	Load and Source LEDs will turn off.

Support

Eaton is proud to offer a comprehensive collection of support resources for users requiring additional information or assistance in the setup, operation, and troubleshooting of GridAdvisor Series II smart sensor and other equipment from Eaton.

For technical support, contact EAS Support at 800-815-2258 or EAS-Support@Eaton.com, or contact your local Eaton representative.

Regulatory information

3G sensor compliance information

GridAdvisor Model: E0013X41G10

Contains FCCID: QIPXS8 and QOQWT12

Contains IC: 7830A-PXS8 and 5123A-BGTWT12A

4G LTE sensor compliance information

GridAdvisor Model: E0013X41G12

Contains FCCID: XMR201707BG96 and QOQWT12

Contains IC: 10224A-201709BG96 and 5123A-BGTWT12A

Federal Communications Commission (FCC)

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 and 24 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet or circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Industry Canada:

This Class B digital apparatus meets all requirements of the Canadian Interference Causing Equipment Regulations. 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.

Anatel

Anatel homologation: 3670-15-8433, (01)07898994273486

GridAdvisor Model: E0013X41G10

Este equipamento opera em caráter secundário, isto é, não tem direito a proteção contra interferência prejudicial, mesmo de estações do mesmo tipo, e não pode causar interferência a sistemas operando em caráter primário.

This equipment operates on a secondary basis and, consequently, is not entitled to protection against harmful interference, even stations of the same type and may not cause interference to systems operating on a primary basis.

Radio frequency (RF) exposure

In accordance with FCC requirements of human exposure to radio frequency fields, the radiating element shall be installed such that a minimum separation distance of 20 cm is maintained.

Important battery information

- Do not disassemble or open crush, bend or deform, puncture or shred
- Do not modify or remanufacture, attempt to insert foreign objects into the battery, immerse or expose to water or other liquids, expose to fire, explosion or other hazard.
- Only use the battery for the system for which it is specified
- Only use the battery with a charging system that has been qualified with the system per this standard. Use of an unqualified battery or charger may present a risk of fire, explosion, leakage, or other hazard.
- Do not short circuit a battery or allow metallic conductive objects to contact battery terminals.
- Replace the battery only with another battery that has been qualified with the system per this standard, IEEE Std 1725™-2006 standard. Use of an unqualified battery may present a risk of fire, explosion, leakage or other hazard.
- Promptly dispose of used batteries in accordance with local regulations
- Battery usage by children should be supervised.
- Avoid dropping the sensor or battery. If the sensor or battery is dropped, especially on a hard surface, and the user suspects damage, take it to a service center for inspection.
- Improper battery use may result in a fire, explosion or other hazard.

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