Smart Sensors

1. Scope

This specification describes the features, specifications, and operation of Eaton's Cooper Power series GridAdvisor Series II smart sensor.

The GridAdvisor Series II smart sensor shall be a communicating, energy harvesting sensor used to detect and report faults on the primary line or on the neutral wire of a capacitor bank. Additionally, the sensor shall provide load profiling and internal diagnostic information for planning and maintenance purposes.

2. Applicable standards

The GridAdvisor Series II smart sensor shall conform to the following standards:
- IEEE Std 495™-2007 standard "Guide for Testing Faulted Circuit Indicators."
- ISO 9001 Certified Quality Management System

3. Features

3.1. Physical features

3.1.1. Attachment mechanism

The sensor shall use a spring actuated clamping mechanism for attachment to the line. The sensor shall be deployable on a wide variety of wire and cable sizes, anywhere from 0.25 inches to 2 inches in diameter. The clamp shall have a trip lever and the sensor shall have an anchor point for a shotgun stick, making it shotgun stick-installable for reduced installation time and cost.

3.1.2. Visual indication

The sensor shall be equipped with a pair of high-visibility, multi-colored LEDs for visual indication of system conditions and device status. The LEDs shall be visible in daylight up to fifty feet.

3.1.3. Battery/SIM compartment

The sensor shall have a water-tight compartment for the battery and Subscriber Identification Module (SIM) card. This compartment shall be accessible for replacement of battery and SIM card, with the rest of the unit fully sealed with potting material.

3.2. Operational modes:

3.2.1. Faulted Circuit Indicator

The sensor shall be capable of operation as a Faulted Circuit Indicator (FCI). When deployed as an FCI, the sensor shall use a variable-trip current design, targeting on a rise in current as opposed to a minimum pickup for load-independent configuration and reduced engineering effort in deployment. The sensor shall be able to differentiate between a sustained and a momentary fault, and report the fault accordingly.

3.2.2. Capacitor Bank Monitor

The sensor shall be capable of operation as a Capacitor Bank Monitor (CBM). As a CBM, the sensor shall be deployed on the neutral wire of a capacitor bank and reports when an overcurrent threshold is surpassed, indicating a phase imbalance due to a failure of the capacitor bank, switch, or fuse.

3.3. Communications

3.3.1. Reported values
The sensor shall be able to report a number of values to a DNP master station. This includes the setting and clearing of fault targets, as well as load profiling data and a number of system conditions and internal diagnostic data.

3.3.2. Communications protocol
The GridAdvisor Series II smart sensor shall be a DNP3 level 2 compliant device.

3.3.3. Bluetooth module
The sensor shall have an embedded, class 2, Bluetooth® radio for device configuration. For security reasons, the Bluetooth® module shall be disabled while the cellular radio is active and manually enabled by an operator in close proximity to the device or remotely via the SCADA master. Additionally, the Bluetooth® radio can be enabled and used *in place* of the cellular radio for SCADA communications to a local Bluetooth® device.

3.3.4. Cellular modem
The sensor shall have a CAT M1 cellular modem capable of supporting a wide variety of 4G/LTE networks.

3.4. Global Positioning Service (GPS)

The sensor shall be able to report its location via GPS coordinates when a fix on a sufficient number of satellites can be obtained. The reporting shall be limited to on power up and on demand to minimize impact to battery life.

3.5. Configuration software

The sensor shall be supported by configuration software capable of connecting to the sensor via the Bluetooth or cellular radio and able to read and/or change configuration parameters, display real-time and profile data, and update firmware.

3.6. Configurable parameters
To maximize versatility, the sensor shall have a number of configurable parameters including but not limited to:
- Modem type
- Authentication credentials
- DNP configuration (addressing, deadbands, URBE configuration, etc.)
- Sensor mode (FCI vs. CBM)
- FCI variable trip level (di/dt)
- Minimum sustained outage duration
- Overcurrent alarm thresholds
- Demand current interval

4. Specifications

4.1. Physical characteristics

4.1.1. Enclosure
The enclosure shall be a fully submersible, suitable for outdoor use in direct sunlight per the IEEE Std 495™-2007 standard.

4.1.2. Weight
The sensor shall be lightweight at 2.42 lbs (1.1 kg).

4.1.3. Environment
The sensor shall be suitable for use over a temperature range of -40 to +85 degrees Celsius (-40 to +185 degrees Fahrenheit).

4.2. Electrical characteristics

4.2.1. Voltage rating
The sensor shall be tested and certified up to 69 kV line potential.

4.2.2. Current transformer
The current sensing accuracy shall be +/- 2% up to 600 A.

4.2.3. Fault Magnitude
The sensors shall measure and report fault magnitude up to 20kA.

4.2.4. Frequency
The sensor shall operate in the 50Hz or 60Hz frequency range.

4.2.5. Battery
The battery shall be a lithium phosphate battery rated at 3.2 V, 1.5 Ah. The expected battery life if kept properly charged shall be 8 years.

4.2.6. Modem transmit power
The cellular modem shall be capable of 2W maximum transmit power per FCC standards.

4.3. Warranty
The sensor shall have a warranty period of 18 months from shipment or 12 months from installation, whichever comes first.