

Technical Specifications

LIGHTHOUSE MV

Line Voltage	4 to 35KV
Conductor Size	#6 AWG to 795 MCM (approx. 0.162 – 1.026 in. diameter)
Mounting Method	Fiberglass reinforced plastic (FRP) clampstick (hotstick)
Case Dimensions (H x W x D)	152 x 305 x 127 mm (6 x 12 x 5 in.)
Antenna Height	210 mm (8.3 in.)
Weight	2.7 kg (6 lbs.)
Operating Temperature	-40°C to 50°C (-40°F to 122°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Power	Inductively upon installation and securing with clamp
Energy Storage	Maintenance free super capacitors
Visual Indication	Single LED
Wireless Frequency	902 to 928 Mhz
Modulation	Frequency hopping spread spectrum (FHSS)
Testing	FCC Part 15, Subpart C, Section 15.247
Security	56 bit Data Encryption Standard (DES)
Measurements	Current (12 to 600 RMS amperes) Fault Current (to 21 kiloamperes) with waveform capture Conductor temp. (-40°C to 100°C) Electric field
Events	Power outage and restoration Fault detection and location

LIGHTHOUSE AG

Mounting Method	Bracket provided for utility pole mounting with 5/8 in. through bolts or lags
Enclosure Material	Fiberglass reinforced polyester
Enclosure Rating	NEMA 4X/IP65
Enclosure Dimensions (H x W x D)	356 x 305 x 216 mm (14 x 12 x 8.5 in.)
Antenna Height	229 mm (9 in.) (Down mount to enclosure)
Weight	13.6 kg (30 lbs.)
Operating Temperature	-40°C to 65°C (-40°F to 149°F)
Storage Temperature	-40°C to 85°C (-40°F to 185°F)
Power	120/240 VAC
Energy Storage	Battery
Wireless Frequency	902 – 928 Mhz
Modulation	Frequency hopping spread spectrum (FHSS)
Testing	FCC Part 15, Subpart C, Section 15.247
Security	56 bit data encryption standard (DES)
WAN Interface	10/100BaseT Ethernet port
WAN Options	Space and power provided for incorporation of third party modules (digital cellular, ADSL, fiber media converters, etc.)

LIGHTHOUSE SW

Operating System	Linux
Database	MySQL®
Web Server	Apache
Northbound Interfaces	Standards-based API
Features	Substation, circuit, and sensor views on map Parameter graphs Event summary Waveform display Reports
LightHouse Maintenance	Configuration Set threshold/parameters Diagnostics Download firmware



Continuous Grid Intelligence™

Today utilities face unprecedented challenges from regulators and customers to improve reliability and increase efficiency. Tollgrade answers this challenge with LightHouse™ advanced sensor technology for continuous grid intelligence.

Advanced sensor technologies are essential to the evolving electric distribution grid for improved reliability, optimized asset utilization, and reduced operation and maintenance costs. Often, little is known about the state of the distribution grid between the substation and the meter unless a problem is visually observed by field crews or reported by customers. Critical decisions are commonly based on field experience and judgment, rather than actual system condition information.

Tollgrade's LightHouse solution is designed to provide real-time grid intelligence by using sensors that continuously monitor key circuit parameters and transmit them over a self-configuring wireless mesh network to a central location.

LightHouse is easily installed and integrated into enterprise applications such as outage management systems (OMS), SCADA, and distribution management.



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Outage Notification/Tracking

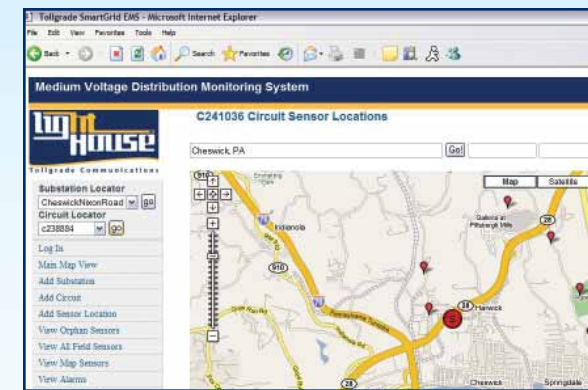
LightHouse's immediate outage and restoration notification enables the utility to provide real-time information on circuit status, by segment, to customers and field crews. Using an OMS, LightHouse's circuit segment outage information can be correlated with customer outages to build a comprehensive understanding of the outage's scope. Restoration can be tracked as segments are repaired and reenergized, enhancing the safety of field crews and providing critical status to affected customers.

Real-time Fault Detection

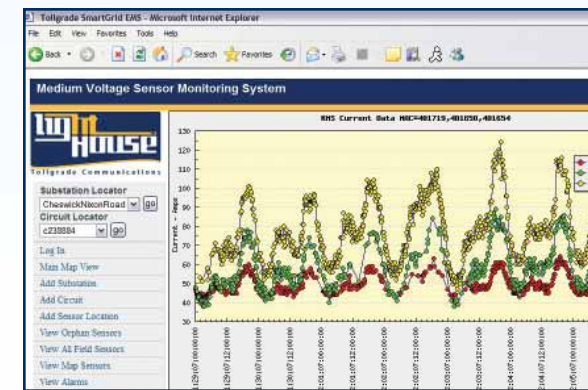
LightHouse records fault current events, by circuit and phase, to a resolution of one sensor span. This facilitates rapid dispatch of repair crews to the correct location, improving circuit and system SAIDI by reducing time spent patrolling the circuit to find the fault. Fault waveforms and propagation sequencing by LightHouse sensors can be made available for detailed post-event analysis.

Continuous Load Monitoring

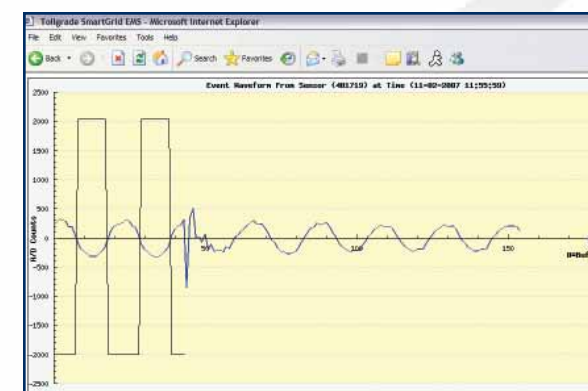
LightHouse provides accurate data to make short and long term decisions on load balance, overload relief, and capacity upgrades. Real time load knowledge is essential for safe automated or manual switching for service restoration schemes.



Real-time Map View



Three Phase Current Plot



Fault and Event Wave Form

Continuous Grid Intelligence

LightHouse is an integrated system of easily-installed line-mounted sensors for medium voltage distribution grids. The LightHouse MV sensors form a secure wireless mesh communications network that can easily grow and expand for greater system coverage. Using field-proven 900MHz frequency hopping spread spectrum (FHSS) technology, which does not require secure site licensing, a robust mesh is formed that dynamically adjusts paths for reliable communications to the LightHouse AG aggregation point.

The LightHouse AG mounts to a substation structure or utility pole and bridges the wireless domain into the utility's network. Information comes together in the LightHouse SW server, to be viewed locally or exchanged with other enterprise applications.

LightHouse MV

LightHouse AG

Distribution Circuit 1

Distribution Circuit 2

LightHouse MV
Advanced Sensor Technology



Simple installation
Using standard techniques

LightHouse MV

The LightHouse MV quickly and easily clamps directly onto overhead conductors using a line worker's standard hot stick. Units are inductively powered and have the ability to store energy to maintain communications in the event of an outage. When installed, LightHouse MV sensors automatically join the wireless mesh for communications. They continuously measure current and conductor temperature, reporting significant events (fault current, outages, power restoration) as they occur. Fault current event waveforms are stored for future analysis.

LightHouse AG

The LightHouse AG mounts to a substation structure or utility pole, and is powered from secondary 120/240 VAC. It aggregates the wireless information from multiple LightHouse MVs and enables bi-directional communication to the LightHouse SW. Its battery backup enables

uninterrupted reporting in the event of a power outage and subsequent restoration. The LightHouse AG is capable of flexibly accommodating multiple backhaul mediums such as digital cellular, fiber, and DSL, via a standard Ethernet port. Backhaul devices can be optionally integrated into the LightHouse AG cabinet.

LightHouse SW

LightHouse SW, a server-based, service-oriented software application, forms the central repository for LightHouse MV data and events. It allows map-based viewing of grid information organized by substation, circuit and phase. The software enables LightHouse AG and MV maintenance functions such as diagnostics, parameter settings and firmware upgrades. LightHouse SW is the conduit to exchange information with other complementary systems such as OMS, SCADA, and distribution management through standardized published application programming interfaces (APIs).