



UM3+™ Underground Line Sensor

The UM3+ intelligent line sensor is a field proven solution that makes Sentient Energy's advanced grid analytics available for underground distribution circuits.

The UM3+ extends the capabilities of the MM3™ and ZM1™ line monitors to underground circuits to detect, capture, analyze, and communicate faults and non-fault disturbances. Its modular design offers utilities the ability to monitor up to twelve phases with one complete solution, whether it be in a padmounted switch cabinet or vault or ring main unit.



Deployment Versatility

The UM3+ can monitor three to twelve phases to support a range of underground installations including pad mounted transformers, pad mounted switch cabinets, ring main units (RMUs), and above grade vaults. There are three options to power a UM3+. Two options use power harvesting (with 1 or 2 harvesting cores) and the third option utilizes the AC power.

Proven Multi-Communications Solution

As with Sentient Energy's MM3 and ZM1 overhead devices, the UM3+ is designed to communicate using cellular carriers' LTE networks as well as Advanced Metering Infrastructure (AMI) and Distribution Automation (DA) mesh networks, just. This multi-communications capability has been deployed and proven in tens of thousands of devices in the field. The UM3+ supports Itron (SSN) and leading 4G/LTE carriers; additional communications options are available upon request. The UM3+'s local processing and advanced analytics capabilities reduce communications cost/burden by transmitting only key event information, in real time and by exception, while forwarding detailed data only upon request or when bandwidth is available.

SAIDI: Fault Detection and Location

Sentient's UM3+ Grid Monitor app (cFCI®) uses advanced fault detection algorithms, capable of wirelessly communicating fault information immediately to the utility control center via SCADA/DMS or OMS. With cFCI, operators can dispatch crews to the correct location based on an immediate alert notification, supported by visual indication which enables crews to confirm that they have arrived at the proper site.

Load Monitoring and Phase Balancing

Sentient Energy's UM3+ Log-I app continually measures current values and determines the most useful values and averages for load monitoring purposes. This collected data is processed on the device itself to extract critical information and derive accurate line conditions. Average logging data and statistics (such as alerts and daily peaks) are reported back to Sentient Energy's Ample® Analytics and Grid Analytics System. This load information enables grid operators to adequately address phase imbalance. With visibility into network loading conditions gained from the Log-I app, asset utilization is maximized by basing replacement decisions on accurate, real data rather than best-guess simulations or state estimations.

SAIFI: Fault and Disturbance Oscillography

Equipped with high-resolution waveform capability at a rate of 256 samples per cycle, Sentient Energy's UM3+ can capture and record fault and disturbance waveforms that occur in underground cables and underground equipment. Waveforms are used by grid analytics and disturbance management applications to identify probable fault causes or identify failures before they cause outages. Complete fault event and disturbance waveform data is stored locally on the UM3+ and is available to download as and when needed. The Sentient Energy Grid Analytics System™ provides analyses, reports and visualization tools that enable utilities to shift from reactive mitigation in restoring outages and repairing equipment to proactive identification of pre-fault anomalies to prevent outages.

Sentient Energy's Ample Analytics Platform

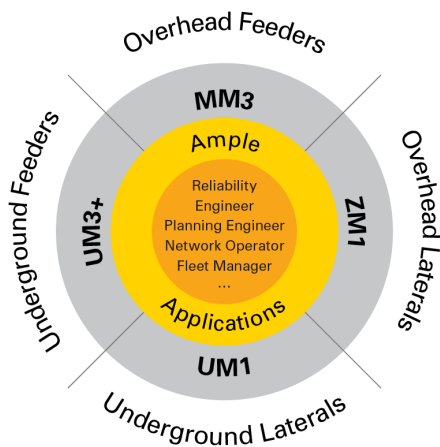
The Ample Analytics suite, along with the UM3+, empowers the utility operator to review waveforms and device health, and make desired modifications to data collection. UM3+ integrates seamlessly into Ample and provides critical information on lateral and low amp feeder lines.



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A Complete Grid Analytics System

Sentient Energy's Grid Analytics System consists of the MM3™, ZM1™, UM3+™, and UM1™ line sensors, and the Ample Analytics Platform. Each sensor features fault detection and load monitoring capabilities, an LED indicator, GPS, and integrated cellular or mesh communications. The MM3 is used for overhead feeders and the ZM1 monitors overhead laterals as well as low load feeder segments. The UM3+ addresses underground feeders while the UM1 monitors underground residential distribution. All four sensors are designed to maximize the amount of system data gathered while transmitting only the necessary information.



Key Characteristics

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| Monitoring Locations Phases/ Conductors | Padmounted switch cabinet, Vault, Ring Main Unit, Up to 12 conductors |
| Wireless Communications (WAN) | Mesh – Itron (SSN), Cellular: AT&T, Verizon; Other available upon request Communications Protocol: DNP3 ¹ |
| Configuration and Software Upgrades | Remote over the air |
| Current, Fault Withstand | 0 to 600A RMS operating, Up to 25kA RMS fault current |
| Waveform Capture | 256 samples/cycle (15.3 KHz), continuous 24 x 7, 1st – 31st harmonics |
| GPS | Latitude/Longitude; precision time stamping |
| Operating Environment | -40°F to +185°F (-40°C to 85°C) Up to 35kV |
| Powering Options | Single harvest core with 12A or more, dual harvest cores with 8A or more, 100-240V AC |
| Conductor Size | 1.5" – 2.4" (1000 KCMIL cable or smaller) |
| Physical Size and Construction | 9.1"W x 14.4"L x 4.36"D |
| I-RF (Indication and Communications) Module Size | 5.5" (Diameter) x 3.25" (Height) |
| Supported Switch Manufacturers | S&C, ABB, Hubbell, Federal Pacific, G&W, Trayer, Siemens |
| Qualifications | ANSI@/IEEE495-2007; FCC part 15 Class B, IP-67, ASTM B-117 salt spray, ASTM G 155 UV exposure |
| Event Notifications / LED | Immediate network messaging, LED FCI-type indicator and on enclosure system operational LEDs |
| Availability / Normal | 100% available, unlimited 2-way communications |
| Availability / Outage | Typical 3-4 hrs. at ambient conditions, sensor and communications at full operation |
| Installation | Designed for ASTM B-117 Class 2 glove installation Magnetic and Bracket mount options available |

¹DNP/IEC 60870-5-104 through concentrator

Ample® Analytics Platform

Sentient Energy's Ample Analytics Platform is a comprehensive set of software tools that turn sensor data into actionable insights for network operators, reliability engineers, and planning engineers. In addition to providing data visualization and analytics, Ample streamlines sensor fleet management and integration of sensor system data into existing OT systems.



Visibility, Analytics, and Control for a Better Distribution Grid

Sentient Energy®, a Koch Engineered Solutions company, is the premier provider of intelligent sensing, data analytics, optimization, and control technologies for the distribution grid. Sentient Energy's hardware and software solutions help electric utilities make data-driven decisions to enhance the delivery of safe, reliable, and efficient power. With the industry's only Grid Analytics System™ that covers the entire distribution network, Sentient Energy leads the global market with the largest network of line sensor deployments in North America, gathering rich data in real time for predictive insights and strategic grid management. Sentient Energy's Grid Edge Control solutions enable utilities to reduce energy costs at the grid edge through Volt-VAR optimization, conservation voltage reduction, and peak demand reduction. Sentient Energy partners with leading communications network providers. For more information visit www.sentientenergy.com.

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