

Remote Site Monitoring

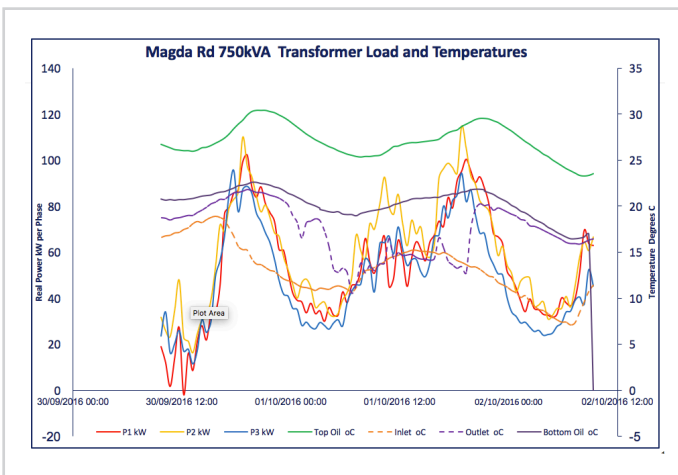
The K^eLVN Monitoring Subsystem allows for the easy and rapid deployment of monitoring technology to remote sites such as electricity substations. A network of sensors measure temperature, low voltage network substation voltage, current and power. The sensors communicate these readings to a Hub, which reports this

information daily back to a central database. All sensors and Hub are easy to install – magnetic or cable tie mounting, battery powered, and wireless connection. They are designed for a minimum 3.5 year lifetime on batteries, and can have a boost battery installed where longer life is required.

Monitoring System

Example Data Gathering

The K^eLVN monitoring system collects data from electricity substations to analyse the relationship between the power transferred through the substation and the temperature of the various assets within the substation.



The data collection system gathers data from a variety of sensors to a Hub, and the Hub reports this via the cellular network to a back end data analysis system on a daily basis.

The substation monitoring system will take samples from a variety of sensors measuring temperature, Voltage and Current (RMS and THD), and Power (Real and Reactive).

Ease of Retrofit

It is important that the substation monitoring can be installed in a non-intrusive manner without having to take any equipment off line, and can be installed and configured as quickly and simply as possible.

K^eLVN monitoring sensors:

- can be easily mounted using magnets or cable-ties.
- connect to the aggregation hub by local radio to avoid wires.
- are battery powered to avoid the need for a mains power supply.
- avoid all wires other than those used to directly connect to the measurement point.

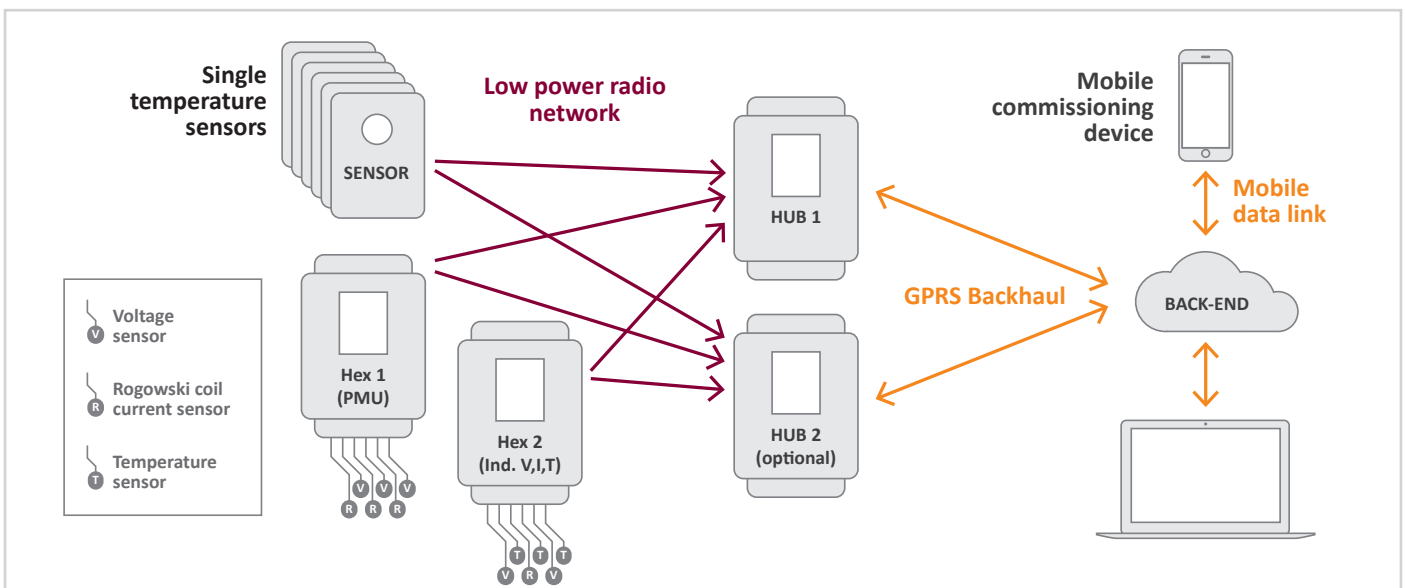
Local Radio Network

The Sensors communicate with a Hub over a distance of 30-100m, depending on obstructions, and multiple Hubs can be used to pull information from a group of up to 30 sensors to cover difficult areas.

The K^eLVN low power radio air interface is optimised for achieving long battery life while passing small packets of information in a local area with a harsh radio multipath environment.

Remote Site Data Collection

Data Monitoring System



The Hub (KHB) acts as low power radio concentrator, with cellular modem. There may be several Hubs in a remote site to cover large substations and severe shadowing situations. **KHB01** is a battery powered monitoring unit for data logging. **KHB02** provides for real time alarms and data logging. It requires external powering.



Single Temperature Sensors (KTS01) measure the temperature at a specific point. This can either be ambient conditions or the surface temperature of particular assets.



Hex Sensor (KHX01) units can be used to monitor 6 independent inputs using flying leads to measure Temperature, Voltage or Current. Hex Sensor units can also be configured for Power Measurement, and use paired Voltage and Current Flying Leads to measure power on up to 3 phases.



Modes of Operation

Sensors and Hubs have 3 modes of operation: Off, Normal Operation and Test Mode. Units are turned on, and temporarily switched into Test Mode, by use of a magnet. Test Mode is enabled to assist in the installation and configuration of the local network.

Normal operation is defined by the Hub, this is either Battery Monitoring (data logging only) or Real Time (data logging and alarms).

Backhaul

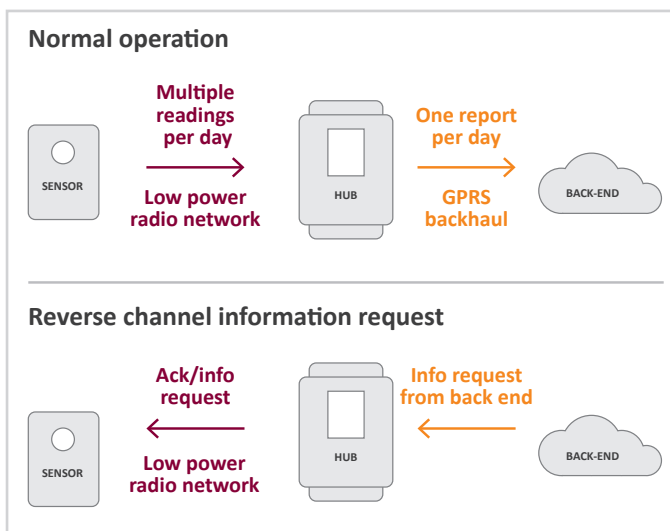
The Hub has a cellular modem and SIM card, and this enables daily reporting of the collected data to the back end system for storage and analysis.

Additional flexibility in current measurement

Where it is physically difficult to measure the total current for a phase, a summation box can add the Rogowski coil inputs for several ways. This makes it easier to gather information from accessible points on a distribution panel.

Reported Data

Message Flow (Battery Monitoring)



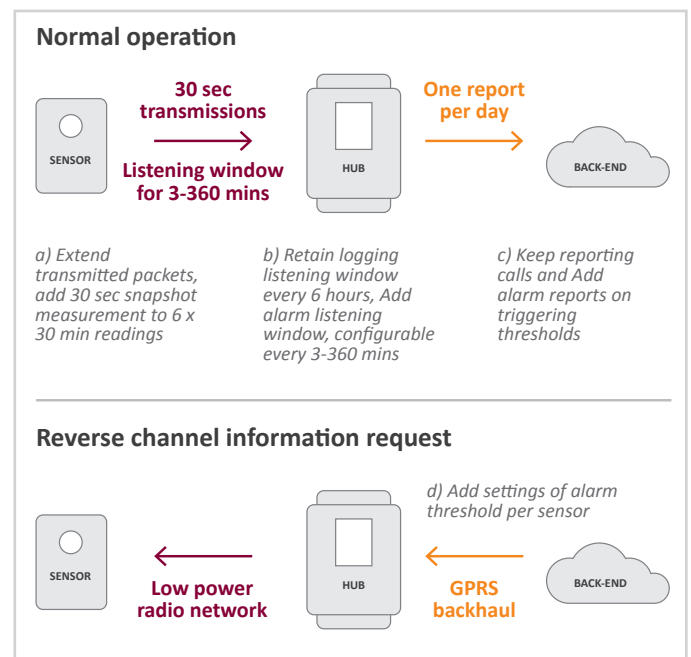
Standard Reports

Standard reported data covers Temperature, Independent Voltage and Current (RMS and Total Harmonic Distortion), and Power Measurement (paired Voltage and Current). Power Measurement includes Real and Reactive power.

These measurements are on a half hour basis (a 30 minute average of 60 x 30 second results). A day's worth of measurements are reported to the back end on a daily basis. In the event of an interruption to the backhaul, 7 days' worth of measurements are stored and available for resending on request. Further detailed measurement is available on demand for analysis of Harmonic content of the power.

Message Flow (Real Time Alarms)

When operating Real Time Alarms, the Hub needs to be externally powered.



Environmental

Temperature range

The operational temperature range of the sensors and hub is -20°C to +85°C. Temperature sensor flying leads go up to +105°C. High temperature version of the flying leads have been developed for transformer oil temperature monitoring.



Weather sealing

KTS is designed to meet IP67. The Hub and Hex will cope with driving rain from vertical down to horizontal, but will not cope with water jets from underneath.

Physical robustness

All units are designed to survive dropping from 1m onto concrete.



Physical dimensions

The KTS Temperature Sensor measures 70x90x20mm.

The KHB Hub and KHX Hex Sensor measure 185x125x90mm.