



GridKey

Continuous substation monitoring



Unlocking the smartgrid
A collaboration between Lucy Electric and Sentec



Overview

GridKey has been producing electrical monitoring systems since 2012. Designed to fit directly onto the distribution network, the GridKey system provides a cost effective, near real-time monitoring solution.

GridKey is a family of substation monitoring systems that can be fitted to the feeders of an LV, or MV substation, typically without interrupting supply to customers.

It provides continuous remote monitoring of the substations, as well as timely warnings, status and loading information.

As a result Electrical Utilities/Distribution Network Operators (DNOs) experience reduced network maintenance costs and significantly increased knowledge of the state of their LV/MV grid.

GridKey is a purpose-designed, live-retrofit, compact, continuous monitoring solution suitable for substations. GridKey provides DNOs with the information necessary to drive LV and MV network planning and financial decisions.

Why is monitoring needed?

The use of electrical networks is changing, patterns of use by consumers are changing together with the introduction of low carbon technologies such as intermittent local generation (for example PV panels) and electric vehicles are accelerating the rate of change. In addition the global rise in the cost of electricity tends to increase the amount of energy theft from the network. In order to effectively manage these networks, it is first necessary to understand how they are operating. Historically this has been done by modelling the network and taking intermittent readings of maximum demand recorded but this only provides a general guide – to maximise the performance of the network, a much better measure is required – this is exactly what GridKey was designed to provide.

The business case for monitoring

There are four areas of actionable information provided by GridKey:

- **Faults** – diagnosing and fixing faults as efficiently as possible gets consumers back on power quickly, minimising labour and material costs for the distribution operator as well as minimising any fines or other payments levied for customer power interruptions. Work is being carried out by GridKey on certain types of fault to predict where and when these faults will occur allowing preventative maintenance to take place
- **Losses** – two types of losses are present: technical and theft. Technical losses are the result of assets, typically transformers and cables getting warm, and are caused by load and harmonic content. Balancing phase loads and minimising harmonic distortion reduce these losses. Theft detection is possible both through the combination of domestic and commercial meter data with GridKey data and also through the detection of certain load profiles
- **Power quality** – meeting the quality standards for supply of electricity to consumers is a statutory requirement: monitoring provides details of voltage profiles including effects such as sag and swell as well as harmonic content
- **Planning** – maximising the life on the network, as well as planning replacement and reinforcement of the assets, is essential to managing capital funding spend. This is only possible by understanding the detailed load and voltage profiles of these assets and then analysing this to determine what actions are required

Low voltage monitoring

GridKey produces three systems, known as the MCU520 (Low Voltage), MCU520 (Medium Voltage) and the MCU318. Each of these communicates directly with the cloud based GridKey Data Centre which stores and then analyses the data received to provide the actionable information detailed above.

Each of the systems consists of a number of current sensors, which are fitted on each phase of each feeder and together with voltage taps are connected to a Metrology and Communications Unit (MCU). This unit then processes the sensor data, generates and logs substation loading and condition parameters. This data is relayed to the Data Centre, where it is securely stored and analysed and can be accessed graphically via our customer web portal (or incorporated into the operator's own data networks).

MCU520 (Low Voltage)

The MCU520 measures the currents of the three phase and neutral, on up to 5 feeders. Designed to be easy to retrofit, the unit can be installed without disruption to supply.

The robust construction allows the unit to be IP65 rated, weatherproof for both indoor and outdoor use - not requiring an earth connection.

Primary communication is via a built-in GPRS modem, although alternative external modems can be connected via an additional module.

The system can provide both regular reports which can be remotely selected at rates from 1 minute to 24 hours. In addition the unit calculates and stores high resolution 1 second data reports and these can be transmitted on request as well as being able to provide a series of programmable alarms for over/under voltage and current.

Current sensing is provided by up to 20 Rogowski coil type sensors – using the GridKey developed GridHound sensors create a Class 1 accuracy solution over a range of 4-720A.

Additional modules also provide the ability to connect a variety of additional sensors such as temperature, intruder or flooding and a modification can be provided to allow a “last gasp” communication in the event of complete power loss.



MCU520 (MV Variant)

A modified variant of the standard MCU520 allows the unit to monitor the MV/HV network. The standard MCU520 is powered from the same voltage taps that are used to measure the phase voltages however when measuring the voltage from a VT output, the load of the MCU (typically around 11W) and the start up transient of its power supply can cause the voltage level to be distorted.

There are two modifications carried out to the unit to allow it to measure MV. Firstly, to separate the power supply for the unit from the voltage measurement taps allowing it to be powered from a separate power source and secondly, to allow the unit to accept current sensor inputs from either Rogowski sensors or CTs with an external ballast resistor.

Metrology

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|---|--|
| Measurement Standards | EN 62053-21 Class 1 for active energy EN 62053-23 Class 2 for reactive energy EN 60044-8 Class 1 for rms current |
| Electrical safety standards | EN 61010-1: 2010, EN 61010-2-030: 2010 |
| Over voltage | 300 V rms Category IV. pollution degree 3 |
| Current measurement range | Accurate up to 720 A a.c. per feeder phase No damage at any over-current condition |
| Operating voltage and measurement range | 230V AC + 15%. -20% rms phase to neutral |
| Line frequency | 50Hz (nominal) |

Protection, Environmental & Compatibility

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|-------------------------------|--|
| IP Rating | IP65 |
| Electromagnetic compatibility | EN 61000-6-2 immunity EN 61000-6-4 emissions |
| Surge protection | EN 61000 6 kV |
| Operating temperature range | -20°C to 55°C (<93% RH, non-condensing) |
| Storage temperature range | -25°C to 70°C |
| Altitude | Up to 2000m |
| Last Gasp Power Supply | Optional module available |

Mechanical

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| Size (h x w x d) | 458 x 285 x 109 (with anti-tamper cover fitted) |
| Weight | 3.25 kg |
| IP category | EN 60529 IP65 |
| Impact | EN 62262 IK06 |
| Power | Power from any phase 9 W typical, 15 W maximum (GPRS enabled) |
| Communications interfaces | GSM/GPRS quad band 850/900/1800/1900 MHz Any network (SIM can be provided by customer) LV TTL Serial – rates up to 1 Mbd Alternative Interface port (RS232, Modbus, Ethernet, DNP3, etc)* |
| *Future expansion via the Auxiliary port | |

Data Reporting/Storage

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| High resolution data | 1 Second data available on request from unit |
| Data reporting period | 1 minute, 10 minute, 30 minute |

MCU318

GridKey is a custom designed continuous monitoring solution for low voltage (LV) networks. The MCU measures three phase only, on up to 6 ways and then synthesises the neutral current.

Quick and safe to connect, it can be retrofitted without the need for interruption and does not need an earth connection.

The system is weather-resistant meeting IP54 using a series of foam gaskets.

Primary communications are through it's very sensitive GPRS modem making the MCU318 perfect for applications that face GSM network challenges, although future developments will allow both Ethernet and RS485 communications as well.

Regular data reports are available and when used with the SlimSensor current sensor provide Class 2 accuracy between 4-720A. At any point in operation, this data reporting and alert messaging settings (for each MCU) can be individually re-configured remotely via its network interface. The operator can select the MCU measurement reporting interval from 1 minute, 10 minute or 30 minute periods, as needed.



Why Choose the MCU318?

- Easy to fit and compact - custom designed for monitoring LV substations
- Robust and durable
- No calibration or maintenance
- Class 2 metering accuracy
- Weather resistant to IP54
- Comprehensive reporting of substation feeders
- 2 year, extendable, warranty
- 2.5G, GSM/GPRS Mobile Data transfer between unit and datacentre

Metrology

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|---|---|
| Measurement Standards | Class 2 in accordance with EN 62053-21 when used with Slimsensor current sensors |
| Electrical safety standards | EN 61010-1: 2010, with corrigendum May 2011 EN 61010-2-030: 2010 |
| Over voltage | 300 V rms Category IV. pollution degree 3 |
| Current measurement range | Accurate up to 720 A AC per feeder phase No damage at any over-current condition |
| Operating voltage and measurement range | 230V AC + 15%. -20% rms phase to neutral |
| Line frequency | 50Hz (nominal) |

Protection, Environmental & Compatibility

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|-------------------------------|--|
| IP Rating | IP54 |
| Electromagnetic compatibility | EN 61000-6-2 immunity EN 61000-6-4 Emissions |
| Surge protection | IEC61000 6kV |
| Operating temperature range | - 20°C to 55°C (<93% RH, non-condensing) |
| Storage temperature range | - 25°C to 70°C |
| Altitude | Up to 2000m |

Mechanical

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|---------------------------|---|
| Size (h x w x d) | 300mm x 245mm x 80mm |
| Weight | 1.35 kg |
| IP category | IP54 IEC 60529 |
| Impact | EN 62262 IK06 |
| Power | Power from single phase only, 6W typical, 11W maximum (GPRS enabled) |
| Communications interfaces | GSM/GPRS quad band 850/900/1800/1900 MHz Any network SIM can be provided by customer |

SlimSensor, GridHound and Flexi Sensor

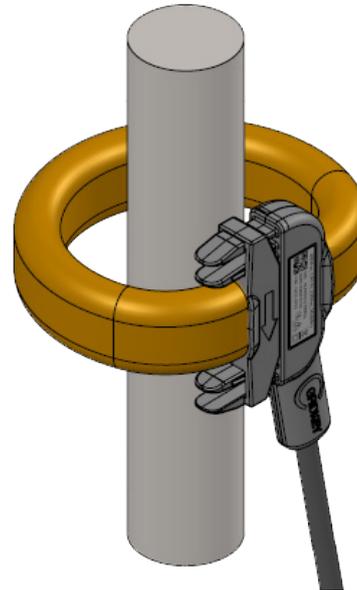
The GridKey systems include a family of high accuracy Rogowski current sensors that are quick and easy to install without the need to disconnect power.

GridKey sensors are rugged enough to survive 10 years of continuous use indoors or outdoors (IP65) and provide up to Class 1 metrology accuracy. With a unique footprint suitable for installation in most substation locations.

GridHound sensors are rigid, incorporating a removable gate to allow retrofit to existing cables. These sensors are sized for 300mm² wavecon cable. When used with the MCU520 GridHound offers Class 1 monitoring accuracy, in 3m, 5m or 10m cable lengths.

The GridKey SlimSensor is the most accurate flexible current sensor of its type and is sized for cables up to 50mm in diameter, but offers a semi-flexible solution, coming in 2m, 4m and 6m. Offering Class 2 accuracy with the MCU318.

Finally a standard rope Rogowski sensor can be installed when a longer sensor is required for example to be guided through a fuse handle. The sensor is modified for GridKey use with a higher isolation rated low cost cable.



Why Choose the GridKey current sensors?

- Quick and easy to fit – one-handed installation on tightly packed cables
- Designed for retrofit and live fit
- Low cost of installation and ownership – no calibration, no maintenance required
- Very accurate current sensors; not position sensitive, no cross coupling
- Robust, durable – designed for 10 years continuous indoor or outdoor life (IP65)
- Monitor all feeder cables simultaneously

Metrology

| | |
|-----------------------------|---|
| Measurement Standards | IEC Standard 60044-8 |
| Electrical safety standards | BS EN 61010-1: 2001, BS EN 61010-2-032: 2002 |
| Sensor Type | Type B sensor as defined in BS EN 61010-2-032:2002, Category IV, Pollution degree 3 |
| Accuracy Class | Class 1 (when used with the MCU520), Class 2 (when used with the MCU318) |
| Rated current | 600A |
| Maximum current | 2000A |
| Output Strength | 150mV AC at rated current |
| Line Frequency | 50Hz |

Protection, Environmental & Compatibility

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|-----------------------------|--|
| Surge protection | IEC61000 6kV |
| Operating temperature range | - 20°C to 55°C (<93% RH, non-condensing) |
| Storage temperature range | - 25°C to 70°C |
| Altitude | Up to 2000m |

Mechanical

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|---|---------------------------------|
| Minimum required clearance between conductors | 14mm |
| Cable Length | 2 m, 4 m, 6 m |
| Aperture | 50mm maximum conductor diameter |
| Weight | N/A |
| IP category | IP65 IEC 60529 |

GridKey is a collaboration between Sentec, the smart grid and metering specialists and Lucy Electric, experts in the design, development, manufacture and integration of a wide range of sensor and data exploitation systems.

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