



UTILITY WEEK EXPLAINS:

# How to drive multiple layers of value through LV network monitoring

## UtilityWeek

Transform with confidence

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In association with



**kelvatek**  
camlin group





A more powerful monitoring solution will enable DNOs to accurately predict and classify where faults will occur, what these faults will look like and how long it will be before fuses rupture.”

Jim McRea, product manager, **Kelvatek**

The energy transition is piling pressure onto the electricity system including an unprecedented need to provide granular insight into activity, asset health and performance at low voltage levels. This Utility Week Explains report, created in association with Kelvatek, sets out how new AI-driven solutions can help power distribution networks to step confidently into the net zero future and drive multi-layered value from their LV monitoring investments.

### Low voltage monitoring and the energy transition

The resilience of low voltage (LV) networks is becoming increasingly critical to the operation of the entire power distribution network as more distributed energy resources are connected to the grid and demand side participation in the energy system begins to grow.

This implies a growing need for pervasive and granular LV monitoring to support close to real time visibility of asset health and performance. However, investment in monitoring of LV networks has not traditionally been viewed as a priority for power distribution networks, offering little in the way of tangible consumer benefits and therefore lacking a clear business case.

This historical underinvestment in LV monitoring has created a situation in which many DNOs are forced to infer views about key factors like LV load growth using data from other parts of their network, rather than using direct intelligence. It has also placed them into a position of reactive LV fault management, with companies commonly waiting for a fuse to blow once or twice before installing reclosing equipment or homing in on fault locations.

This approach cannot continue into a net zero future. As already set out, not only will the energy transition increase pressures on the LV network and the dependency of consumers on its resilience. It will also make management of the LV network a significantly more complex task because on a more integrated network, it is harder and harder to disentangle load, fault and asset degradation issues from one another, and to understand the links between the three so as to form a clear view of the correct intervention to perform.

But it's not just the net zero context which is piling pressure on DNO's to rethink their approach to investment in LV monitoring and the granularity of information they need from these parts of their networks. Regulatory factors too should be driving an appetite for change.

According to analysis of industry data carried out by Kelvatek in the UK, up to 50% of faults at LV level are permanent ones which cannot be remedied by a fuse alone in the first instance. Given this, the current reactive approach to fault response could be causing DNOs to significantly underperform against their potential in terms of regulatory measures for Customer Interruptions (CIs) and Customer Minutes Lost (CMLs). A more predictive capability could help to deliver a step-change in the quality of supply and allow networks to access outperformance rewards.

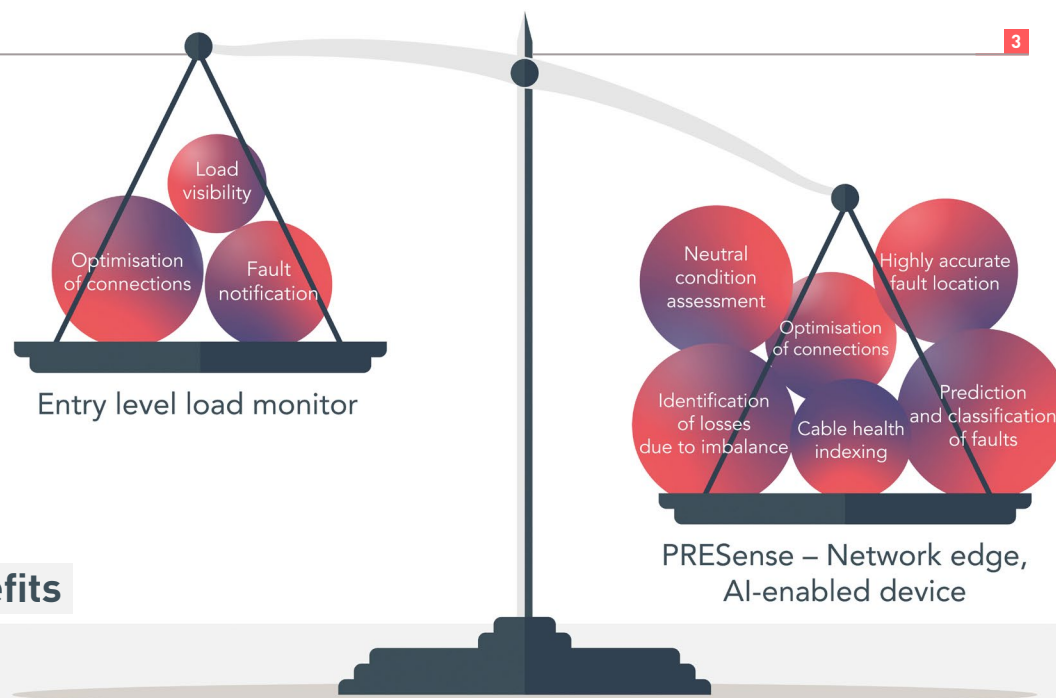
## Options for extending low voltage monitoring

One way to remedy the current paucity of low voltage intelligence in the UK might be to install as many monitors as possible, at the lowest cost achievable, across swathes of the networks with the aim of building a clearer picture of load profiles.

Such an approach, necessitating installation of LV monitoring devices at a high percentage of substations, would indeed be helpful in improving visibility of load growth and diversity challenges. It would also give widespread visibility of capacity issues, supporting more accurate and effective decisions around asset reinforcement or investment deferral, although with some predicting 50% penetration of smart meters on their networks by 2024, there is a case to be made that more use could be made of smart metering data to provide a reasonable representation of what is happening at LV level.

But this straight forward, if rather operationally intensive, approach to improving LV network intelligence potentially misses a bigger opportunity. Yes, it would bring important visibility of fault occurrences and, to some extent, location. However, the ability to improve fault prediction, support highly accurate fault location or inform a running picture of LV cable health and load carrying capabilities may be restricted and is certainly operationally unproven. For this kind of intelligence, more powerful, long term monitoring capable of tracking both load and fault dynamics is needed.

**50%** of faults at LV level are permanent ones which cannot be remedied by a fuse alone in the first instance



## Low voltage monitoring lifetime benefits

### Advances in LV monitoring

To support that more holistic view of LV management, maintenance and investment requirements, Kelvatek has worked to incorporate a range of advanced capabilities, based on technologies such as edge computing, artificial intelligence (AI) and Machine Learning, into a single LV monitoring product which is available to the industry to apply today.

The holistic platform which encapsulated all this powerful technology is **PRESense**. It uses AI-driven edge computing to enable the proactive management of LV networks, resulting in a more nuanced approach that considers both load and fault management. With high resolution and adaptable measurement triggers, PRESense can give DNOs the insights required to manage both

immediate pressures on today's network and the more complex challenges they know are coming down the road as decarbonisation gathers pace.

According to Jim McRea, product manager at Kelvatek, "a more powerful monitoring solution such as PRESense will enable DNOs to act based on accurate predictions of where and what type of faults will occur and how long it will be before fuses rupture. With this kind of intelligence, it's also notable that DNOs are well positioned to perform against Ofgem's Interruptions Incentive Scheme (IIS)".

The core characteristics of the platform are that it is highly configurable, in terms of hardware and software, and can therefore be easily reprogrammed to handle a variety of use cases as well as changing circumstances on the network.

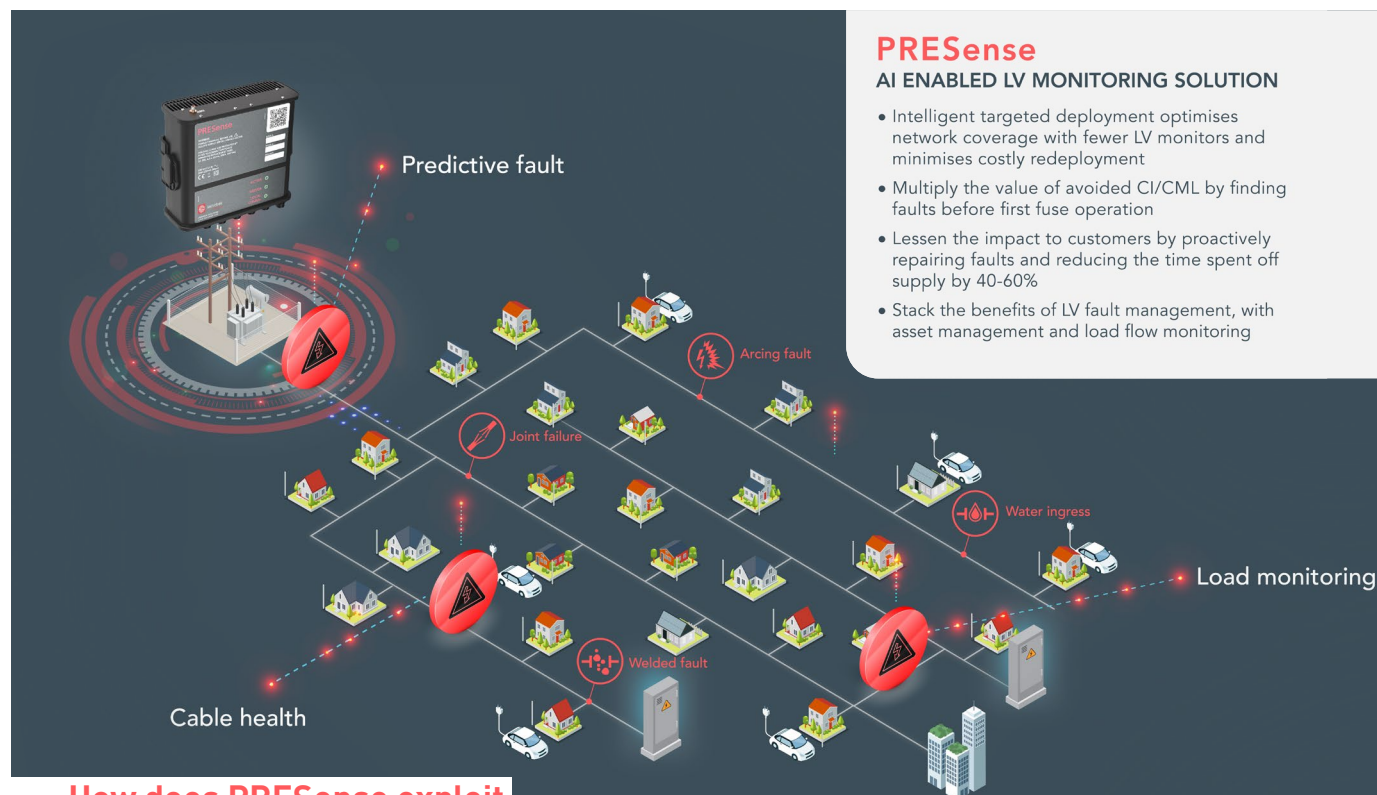
It is also highly predictive, with the capability not only to detect faults ahead of time but also to sense faults as they develop, profile the likely period of time to fuse rupture and even classify if that fuse blow is likely to lead to a burn out or require an emergency excavation.

The triggers Kelvatek has developed within the platform are derived from a wealth of data gathered and analyses by the firm, which has over 20 years of network monitoring experience. They draw on:

- **Over 20 million hours of load data from monitored circuits**
- **More than one million fault events from live, real world networks**
- **Over 20 million fault events from Kelvatek's unique LV test centre**

Once installed at substations and other supply points along a network, PRESense uses these triggers to capture high resolution power flow data and identify problems as they develop, pinpointing their locations and classifications to deliver a Fault Activity and Trajectory Estimate or FATE.

This process is powered by a sophisticated algorithm which in turn feeds a crucial machine-learning decision engine. It is the combination of the algorithm and decision engine which provide PRESense's best-in-class capabilities for fault identification and location, as well as the ease with which it can be reconfigured to provide only the most useful information for any one use case, according to Kelvatek. The latter point is important for networks looking to minimise the cost of data transportation, storage and management while also reaping the rewards of improved network intelligence. It also ensures that the system is not overwhelmed by data and so the time taken to turn that data into actionable information is reduced.



### PRESense AI ENABLED LV MONITORING SOLUTION

- Intelligent targeted deployment optimises network coverage with fewer LV monitors and minimises costly redeployment
- Multiply the value of avoided CI/CML by finding faults before first fuse operation
- Lessen the impact to customers by proactively repairing faults and reducing the time spent off supply by 40-60%
- Stack the benefits of LV fault management, with asset management and load flow monitoring

### How does PRESense exploit edge computing capability?

PRESense utilises edge computing enabled by its powerful processors and a highly configurable platform which enables computation to be done at the source of the data, instead of purely relying on server-side calculations. It offers the opportunity to reduce latency, data transmission and allows multiple complex, adaptive triggers to be deployed on the device itself.

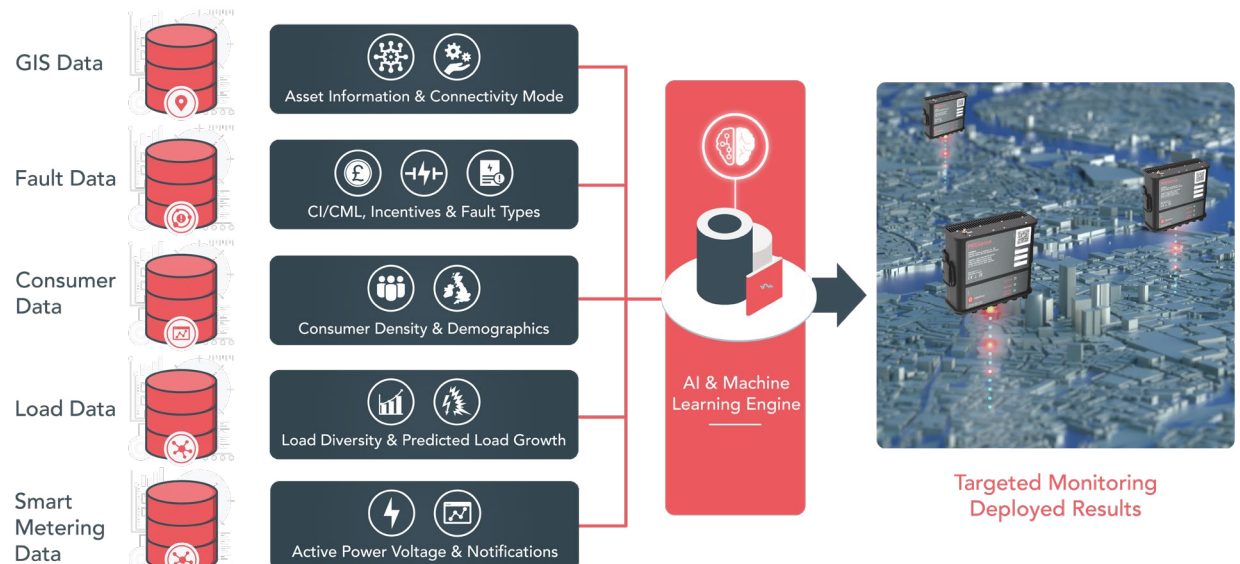
## PRESense benefits in brief

**Kelvatek's** PRESense offering allows DNO's to realise long term benefits for fault management, load management and asset health with a single solution. The solution monitors information collected from individual substation and cable assets, comparing this with the performance of similar networks. It also incorporates the option to combine this insight with other data [e.g. Smart Metering or 3rd party devices] and environmental data such as soil type and water table levels, to predict when, where and how faults will occur, whilst delivering on the primary use case of load visibility.

- PRESense uses AI driven edge computing to enable the proactive management of LV networks, resulting in a more targeted approach to load and fault monitoring, delivering superior value for money taking LV monitoring beyond the baseline challenges presented by increased load.
- PRESense uses information from the network from individual substation and cable assets and learning from the performance of similar networks to predict when, where and how faults will occur.
- PRESense's combination of an advanced algorithm and a data filtering model has three key applications that help DNOs' adopt a proactive approach to fault management while delivering unrivalled network visibility: network health monitoring; cable health indexing; and predictive fault location.

To get your network ready for RII0 ED2, talk to **Kelvatek** about your LV monitoring strategy. [sales@kelvatek.com](mailto:sales@kelvatek.com)

## Targeted Monitoring Methodology





## Top applications for advanced LV monitoring

A network monitoring platform with the level of sophistication offered by PRESense, has three key applications for DNOs. These are:

- **Network health monitoring:** PRESense can capture elements of network health beyond voltage and current data. These include: power factor; phase imbalance data; system frequency; and total harmonic distortion (THD). This data helps identify potential overload situations caused by EVs or increased distributed generation, such as solar panel deployment. This in turn allows DNOs to decide on the most effective form of remedial action at a network level.
- **Cable health indexing:** The high resolution, high frequency data capture that is central to the PRESense platform feeds into Kelvatek's other analytical techniques. They allow

operators to identify and measure key parameters used to detect faults on feeder networks. The triggering algorithm processes these parameters to create a 'health index' for each cable on the system. Again, this helps operators plan ahead when it comes to asset replacement strategies.

- **Predictive fault location:** Data captured by PRESense can be used by Kelvatek's single-ended location of faults (SELF) and multi-ended and multi-point location of faults (MELF) algorithms to predict the distance to either a fault or pre-fault activity well in advance of the point where the fault is noticed by an end user.
- **Smart Metering Data:** Combining PRESense collected data with smart metering data to provide insights on neutral condition assessment, power restoration, feeder connectivity and phase connectivity.

## Reaping benefits from LV intelligence

PRESense is already being rolled out in its thousands in the UK. Commonly, it is being used in conjunction with Kelvatek's SELF and MELF algorithms to identify specific fault activity on its cables far earlier in the fault cycle, allowing the operator to fix faults before any significant disruption of service.

The data captured by PRESense is providing valuable insights around neutral condition monitoring, phase balance, LV losses, maximum demand, thermal monitoring, and cable asset health.

This level of insight moves PRESense far beyond that provided by previously deployed LV monitoring systems, which have focused on load related issues. Using historic data on asset type, configuration and age, PRESense technology can be deployed on areas of the network that have the most need and can deliver the most benefit.

This gives the DNO the confidence that where they have identified the need for monitoring, they have invested once, for now and the future, to protect the LV network, deliver optimum value to consumers and enable them to accommodate changes to their requirements for monitoring on the LV network over an extended period of time.

To date, evidence from live applications of PreSense indicate that targeted deployment on a DNOs network can return the following benefits:

- **A 3-5-fold increase in observable faults which translates to a significant increase in IIS benefits.**
- **Over 50% increase in operational efficiencies by enabling planned proactive repairs versus emergency excavations.**
- **Reduces the amounts of visits to site by up to a factor of 4 when used as a part of a proactive fault repair strategy, also therefore enabling carbon savings.**

## About Kelvatek

For over two decades, **Kelvatek** has been working collaboratively across the UK & Irish Energy industry to accelerate network performance and drive a more sustainable future. We provide industry leading solutions and services for Fault & Load Management, Asset Monitoring and Biogas & Gas Monitoring.

Data – and the insight it provides – drives everything we do. The powerful insights we deliver from our clients' data allow them to maximise returns from current network investments, make strategic decisions, deliver improved customer outcomes and embrace the opportunities of net zero. The data we collect is transparent and open, putting Network Operators firmly in control of their networks.

We exist to engineer better futures. You'll see that commitment reflected in initiatives to make our operations more sustainable, and to help our customers on their own journey to net zero.

Kelvatek is part of Camlin, which has a worldwide presence with facilities in 21 cities across 17 countries. Camlin's goal is to optimise the critical infrastructures that people, cities and communities around the world depend on, all day and every day.

More details of the PRESense solution can be found [here](#).