

LIOS

TECHNOLOGY



Distributed Temperature Monitoring of
Energy Transmission Systems



Ensuring a
Reliable Supply of
Electrical Power for
Today's World



Preventive Measures to Avoid Power Outages



As demand for electricity continues to grow, so do the challenges to power companies and power grids. The liberalisation of power supply markets continues apace, resulting in the reorganisation of national and international networks. Events of the past few years – including large-scale blackouts and shortfalls in major markets, and the ongoing addition of alternative sources to existing networks – point up the need for improvements to existing infrastructures. At the same time, there is increased pressure to keep costs to a minimum.

Monitoring System for Overhead Line Conductors

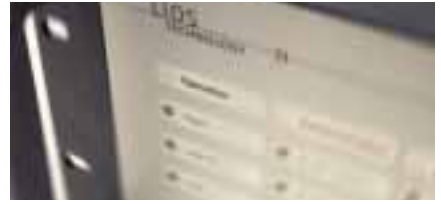
Providing sufficient electrical power reliably requires ongoing monitoring of temperatures within overhead transmission lines. The LIOS Technology monitoring system is an inexpensive and highly reliable method that enables real-time monitoring of an entire network or of selected critical spans. By enabling direct measurement of temperature through variable-length sensors embedded within the cables, it provides for flexible load adaptation and better load control with respect to meteorological and environmental conditions.

The easy-to-install, low-maintenance system offers a multitude of advantages. By enabling dynamic analysis of network structure, it increases the overall safety and reliability of the grid. It facilitates dynamic reactions to transmission requests, resulting in more flexible capacity and revenue management in both the short and long term. And the potential for cost-savings is enormous: Downtimes and blackouts can be avoided, and the need for new lines and upgrades (e.g. increasing the height of overhead transmission lines) can be greatly reduced.

Customers employing the LIOS Technology monitoring system can

- Increase earnings by activating previously unused resources in existing power lines
- Respond quickly and dynamically to transmission requests by online metering of the grid capacity
- Conduct precisely and in real-time load predictions as new sources of energy are added to the grid
- React quickly to overload conditions

With the help of dynamic network-structure analysis, temperature profile can be monitored over span fields and fittings, depending on the length of the sensor. Load parameters are bundled and transmitted to network control stations online, allowing for real-time supervision of network capacity. This makes it possible to predict load precisely and to avoid the wire fatigue caused by repeated thermal loads. Because decisions based on thermal load often influence upgrading or installation of lines, this translates into better control of grid and wire conditions, as well as optimal sag control and line clearance without requiring new construction activities.



Technologies Creating Value



The temperature sensor element is a passive optical fibre that is integrated into the core of a phase wire of overhead transmission lines (OPPC) respectively implemented into or attached to the power cable.

Via joints and high-voltage fibre-optic uncoupling devices, the fibre is linked to an evaluation unit (OTS), where the distributed temperature profile is recorded and can be further processed. The temperature profiles themselves, or the results/events derived from them, can be transmitted via standard interfaces from the evaluation unit as required, and be either displayed or further processed in real time by PC or PLC systems.

State-of-the-art Temperature Measurement System

The LIOS Technology OTS system has been developed for unsurpassed linear fibre optic temperature monitoring performance. The system fulfils the demands of a modern temperature monitoring system which is based mainly on the OTS evaluation unit and an appropriate sensor cable

- Unaffected by rough conditions and electromagnetic disturbances due to the passive sensing characteristics.
- Independently operating system architecture.
- Precise information about hotspot location and temperature.
- Easy to install and easily adaptable to existing management systems.

The LIOS Technology linear temperature measurement system consist of:

- Custom tailored sensor cable for retrofit installations.

- Sensor fibre embedded in the heart of the power cable's cross section recommended for new installations.
- Controller with laser light generation, measured signal evaluation and software.
- Power Supply 24V DC or 115/230 V AC - consumption max. 50 Watt
- Up to 20 relay contacts, unidirectional alarm and trouble outputs for alert generation. (18 main zone alarms, 1 multi-input fault warning signal, 1 fibre break signal)
- Connection to PC's, existing management systems and networks via Ethernet or RS 232 interface

This technology has been successfully proven in critical applications like fire detection in road and rail tunnels, where these systems have been in use in worldwide projects with more than a thousand sensor cable kilometres in permanent installations since 1997.





Sophisticated Answers for Modern Power Management



Better Communication

Due to the high spatial resolution sampling of temperature, long sensor lengths and short measuring cycles, efficient preparation and compression of the volume of measuring data is of great importance. The CHARON_02 configuration and visualisation software associated with the OTS systems was developed for just this purpose. It can be adapted to specific requirements and offers numerous options for displaying and processing the recorded measuring data. This software makes it possible to create zone views which, as the application-related visualisation of the temperature profiles, allows a freely configurable division of the sensor stretches into zones and the configuration of zone-related alarm generation with event handling.

Explore Boundless Visualisation Possibilities with the Enhanced Views of CHARON_02:

- Synchronised measurement browsing even with multiple OTS units connected
- Simplified import and export of configuration sets
- Embedded configuration within all measurement data files
- Ring buffer storage functionality which allows permanent data storage or event (alarm) triggered storage of measurement data
- New measurement data explorer: Easy tracing of requested measurement data by time period, event, OTS number or title/description
- Detailed reports in order to file configurations of commissioned projects

The Excellent All-round Solution to Increase Grid Security and Prolong Working Life of Your Facilities

All in all, the temperature monitoring system offered by LIOS Technology provides an excellent all-round solution to many of the challenges facing power supply companies today. Remote repair, maintenance and calibration of the systems is standard. Maintenance can be performed without requiring interruption of electrical transmission, and even without requiring access to the line. The variable sensor lengths embedded inside the cable provide measurements accurate up to a few degrees centigrade, independent of environmental conditions and weather.

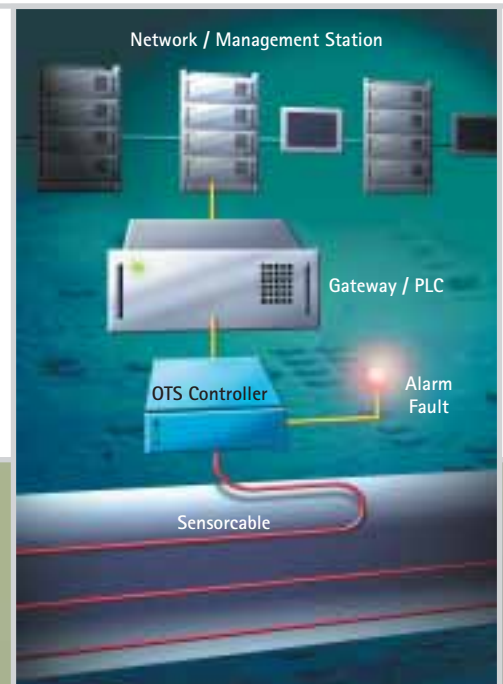
Distributed temperature sensing is a powerful tool that allows to accurately rate power transmission and distribution assets based on actual field conditions. It is especially valuable for dynamic rating, since the accuracy of the temperature modelling can be coupled with the monitoring and the predictive functions of the dynamic rating system.

The actual distributed cable temperature along the entire length of the transmission route provides the right answers to questions regarding:

- Load capacity adaptation at crossings with district-heating conduits or cable bundling
- Load capacity adaptation when conduits are laid for particular route sections
- Utilisation of reserves in extreme situations without having to exceed permissible conductor temperature

- Reduction of outages and improvement of operating efficiency
- Location of cable "hot-spots"

If you are looking for high reliability and low system costs in a temperature measuring system, look to LIOS Technology. We will be happy to show you how you can increase grid security and prolong the working life of your facilities via a complete network-monitoring solution.



System Integration

One or more OTS units can easily be linked into a network in order to bridge distances, summarise signals from several evaluation units or further process the measured data.

Meeting the Demands of a Changing Power Environment



In times where power utilities face growing need of energy – forcing operators to stress the power cables to the physical limit – safety and efficiency becomes more and more important. Undoubtedly, knowledge in real time of cable temperature and thermal behaviour of the cable installation are key to control safety and efficiency of a power distribution network. Regardless of cable design, operational limits or installation practice, the fact is that unforeseeable adverse thermal conditions can and do cause system capacity degradations and service interruptions – especially with fatigue. The monitoring systems by LIOS Technology enable the user to locate any cable hotspot before failure, to dynamically optimize the power load and ensure reliable supplies of electricity by:

- Real time temperature profile measurement.
- Precise localisation of hotspots.
- Multiple alert parameter free configurable for each zone.
- Fibre switch for monitoring different cables resp. phases simultaneously.
- Trend analysis and online interface to accurate rating systems.



Passive and Maintenance-free Sensors for Your Assets

LIOS Technology provides the appropriate sensor cable for retrofit or newly built projects. One vital component is a stainless steel or plastic tube that can accommodate multiple optical fibres. The wall thickness of the sheathing of the tube, and the material used to make the sheathing, can be adjusted particularly to the necessary requirements. For retrofit applications we recommend the use of metal free cable easily mountable on the surface of the power cable whereas new installations should gain from the benefit of embedding an appropriate cable into the power cable directly.





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