

Affordable, resilient protection of multi-ended transmission circuits using passive, distributed current sensors

Scottish and Southern Electricity Networks (SSEN) are responsible for maintaining and investing in the electricity transmission network in the north of Scotland.

Synaptec is working with SSEN to implement a radical new distributed electrical sensing platform that eliminates the need for multiple protection relays and reduces component and infrastructure costs.

A significant step forward for protection of high voltage power systems

Accurate, reliable and real-time protection is vital for maintaining integrity and continuity of service on power networks. The increased drive to integrate new renewable generation within the network has also heightened the multi-ended circuit challenge.

Distance and line differential protection systems typically in use today have a number of drawbacks, including costly, complex infrastructure, time synchronisation and physical space issues, and throttling that can result in incorrect tripping due to poor accuracy levels or drifting zone reach.

Synaptec's new distributed electrical sensing platform solves these challenges, with a compact merger unit that passively and accurately interrogates and measures values from up to 50 current or voltage sensors, using a single optical fibre core over a distance of 100 km.

Working closely with SSEN, Synaptec built and tested its new platform at SSEN's R&D centre in Braco, Scotland. Now deployed on a live operational circuit at Inverarnan, the platform significantly reduces the cost and complexity of protecting multi-ended lines that result from new connection to existing circuits. The solution eliminates the need for multiple protection relays and telecommunications equipment, simplifies time synchronisation systems

and facilitates faster installation of current differential protection schemes over wide-areas.

Using specially modified Fiber Bragg Gratings (FBGs) that allow remote, passive measurement of voltage, current, temperature, vibration or strain, Synaptec's technology leverages the unique range and bandwidth of standard optical fiber using its proprietary Merger system. This interrogates multiple multiplexed sensors by illuminating them and continuously analysing the light reflected to obtain accurate measurements.

Sensors can be spliced safely along the same fiber anywhere measurement is required. Each sensor has a unique photonic and therefore geographical address, operating invisibly to all others.

Synaptec's systems are designed for compliance with industry protection and metering standards, and are designed to exceed typical transmission sector operational lifetimes.

Using Synaptec's platform compared with conventional line differential protection solutions substantially reduces capital expenditure per installation. The system also offers improved protection accuracy in locations where distance protection would have been required due to space constraints, and reduces the likelihood of mal-operation of the protection scheme.

A SYNAPTEC MERGER UNIT IS CAPABLE OF MEASURING UP TO **50 LOCATIONS** SIMULTANEOUSLY IN A **100 KM RADIUS**

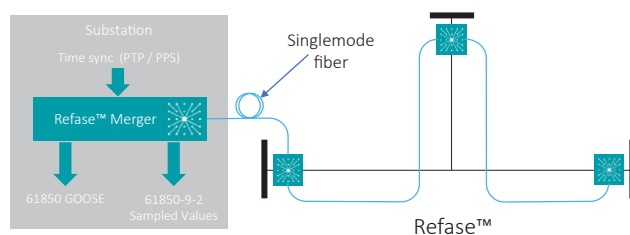
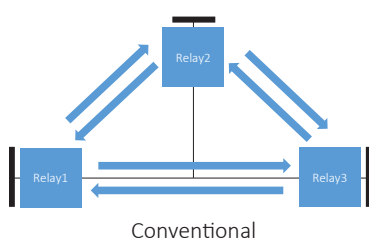


Synaptec solves the challenges of multi-ended circuit protection with accurate, cost-effective and scalable technology.

Distributed electrical sensing is a proprietary technology platform developed in the UK by Synaptec, using specially modified FBGs (Fiber Bragg Gratings) to leverage the range and bandwidth of optical fiber. Measured values can be utilised as part of centralised Protection and Control (PAC) schemes, or communicated to traditional PAC devices for analysis via IEC 61850-9-2 / 61869-9.

By centralising current measurements, this method eliminates the need of having multiple protection relays at each line end, complex time synchronisation systems at measurement points, and complex telecommunications equipment among the distributed devices, resulting in significant infrastructure savings.

All electrical systems must be protected robustly and with a minimum of disruption and total expenditure over their lifetime. With the international IEC 61850 standard defined as a core requirement for Smart Grid, Synaptec's platform is a significant step forward for protection of high voltage power systems.



Example of current measurement topology on generic multi-ended circuit.



To download the full case study, visit synapt.ec

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Synaptec is the leading developer of photonic instrumentation for power networks, enabling operators to reduce downtime, investment and operating costs.

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