Refase™

Faulted section identification for complex circuits

Introduction

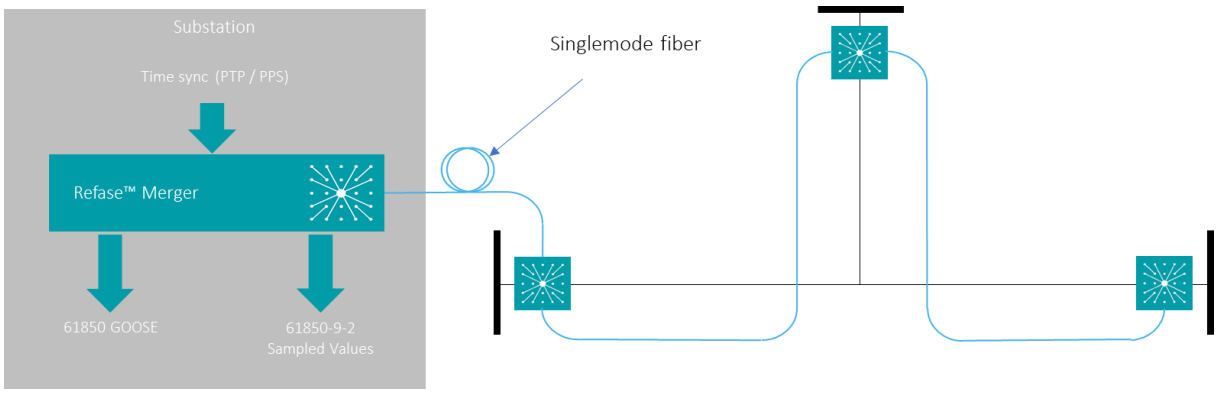
Synaptec's distributed sensing technology is the most efficient and cost-effective way to capture multiple, distributed electrical measurements, providing unprecedented system awareness at the speed of light.

Based on this unique technology, Refase™ (Remote Fault Sensing) is a multizonal instrumentation system which uses distributed current sensing to divide complex (multi-section or multi-ended) circuits into multiple discretely-monitored zones. This allows faulted sections to be detected with speed and precision, enabling post-fault actions to be more targeted, thereby reducing operational and outage costs in multi-ended circuits, hybrid circuits, and distributed power generation.

Applications and benefits

Multi-ended circuits

Protection of multi-ended circuits is challenging either because differential schemes require complex and costly communications systems or because it is difficult to ensure that distance schemes do not under- or over-reach on circuits with different branch lengths. By using distributed current sensing, Refase™ overcomes all these issues by acquiring time-synchronised current measurements from all remote circuit terminals without digital telecommunications.

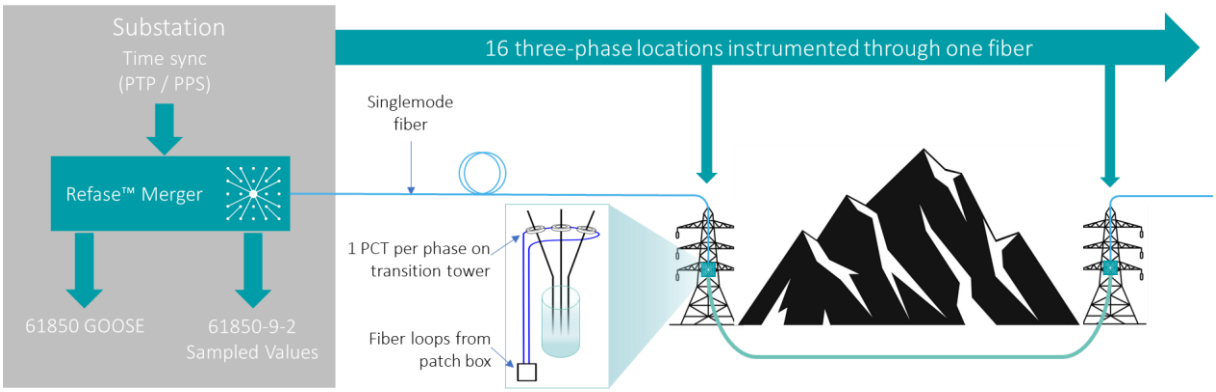


Instrumentation of a three-ended circuit using Refase™

Hybrid circuits (mixed overhead line & cable)

Differential protection for hybrid circuits is relatively straightforward, but the ability to detect with certainty if a fault is on a cable or overhead section of the circuit is challenging. This is particularly problematic if cable sections are too far from the substation to power instrumentation remotely (e.g. for cable fault detection purposes), or where cable transition points are inaccessible and space for auxiliary equipment and housings is restricted.

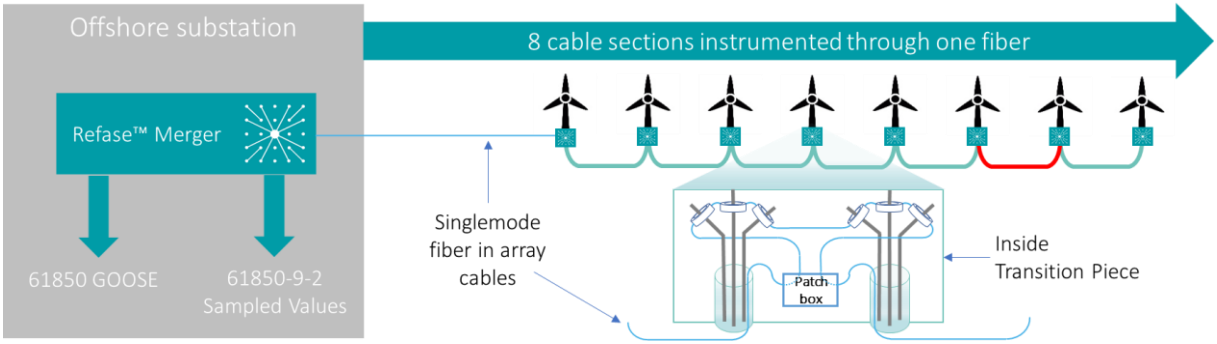
By using distributed current sensing, Refase™ overcomes these issues by providing time-synchronised current measurements from all transition points to enable auto-reclose on transient overhead faults, while blocking reclose commands for cable section faults.



Refase™ instruments and detects faults on cable sections independently within hybrid circuits

Distributed generation (offshore wind)

Due to the high number of array cables and terminations in offshore windfarms, distance protection is often used as a lower-cost substitute for superior differential current protection. Refase™ uses distributed current sensing to instrument eight array cables simultaneously and independently without digital communications. This permits faster and more targeted post fault actions, such as re-closing automatically on non-faulted sections and returning strings to production within seconds to avoid days of outage and associated O&M costs.

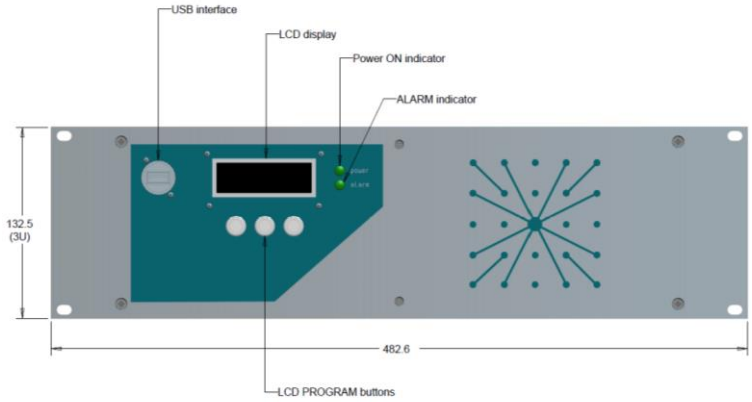


Refase™ automates array cable fault response in strings of up to 8 turbines

Modular components

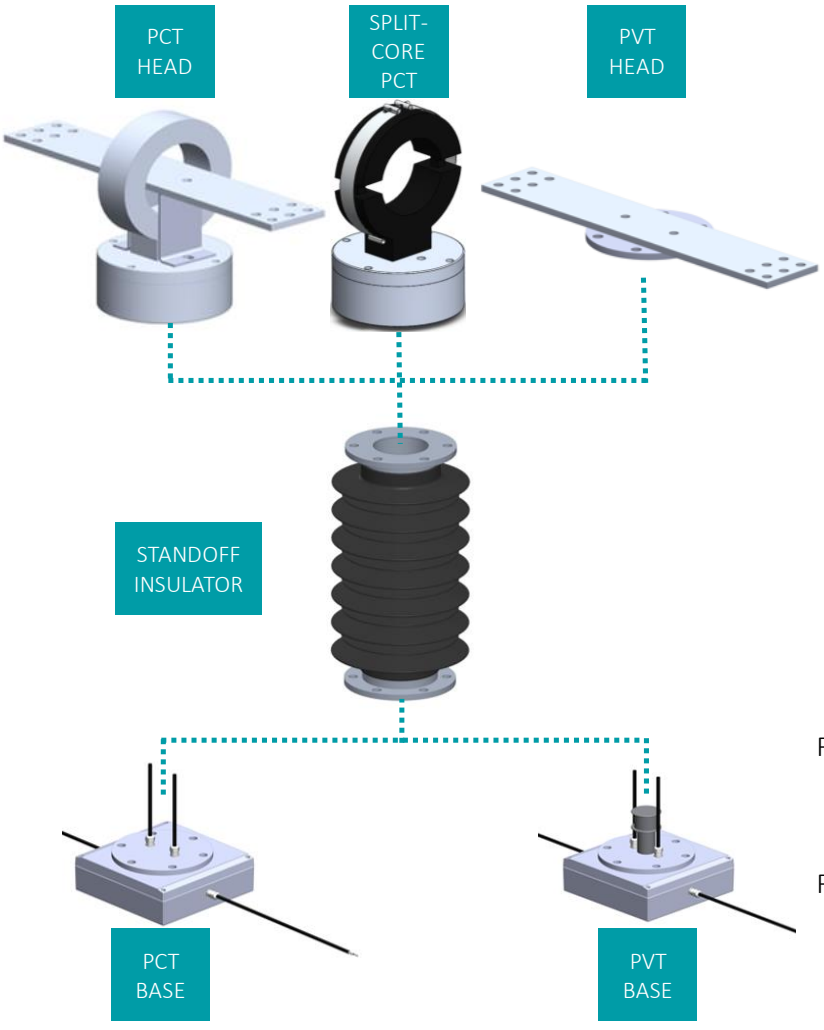
Refase™ systems comprise one Merger unit installed in the substation simultaneously measuring, time stamping and publishing data from 50 distributed sensors which can be configured for a multitude of locations, currents and conductors:

MERGER



- Installed in substation
- 50 distributed measurements processed simultaneously
- 100 km passive measurement range
- PTP & PPS time synchronisation
- Optional 61850-9-2 / 61869-9

MODULAR SENSOR ELEMENTS



- PCT – Photonic Current Transducer
- PVT – Photonic Voltage Transducer
- Split-core PCT for insulated cables
- MV & HV current & voltage support
- Operating temp -40°C to +50°C

- Modular standoff insulator
- Not required for insulated cables
- Configurable for all MV and HV primary voltages
- Full galvanic isolation
- Dry solid insulation

For insulated cable currents, select:

- PCT base + Split-core PCT head

For busbar or overhead line, select insulator and:

- PCT base + PCT head for Current
- PVT base + PVT head for Voltage
- PVT base + PCT head for Current + Voltage

Technical Specifications

REFASE™ CORE PROCESSING UNIT (sensor specifications available on demand)	
MECHANICAL	
Dimensions	19” rack, 3U high
Weight	3 kg
ELECTRICAL	
Power supply voltage	85-264 VAC / 100-370 VDC
Power consumption	50 W
FIBRE OPTIC SENSOR CONNECTION	
Number of connectors	1
Connector type	SC/APC, simplex, 1550 nm
Maximum fibre length	50 km
ENVIRONMENTAL	
Temperature	-5°C to +40°C
IP rating	IP52
PROCESS BUS INTERFACE	
Number of Ethernet ports	2 x IEEE 802.3.u 100 BaseFX (LC duplex)
Sampled value protocol (optional)	IEC 61850-9-2 or IEC 61869-9
Fibre type	Multimode 50/125 µm or 62.5/125 µm
SYNCHRONISATION	
Time synchronisation	IEEE 1588 (PTP) network synchronisation
PPS interface	Multimode ST fibre, 850 nm
USER INTERFACE	
Configuration port	USB 2.0

Revision History				
Revision no.	Date	Revisions	Revised by	Approved by
001	4th April 2017	First Edition	PO	DP
002	30th August 2018	Second Edition	SM	PO