



Ensuring quality of assembly work and reliable continued operation of power cables

- Highly accurate periodic PD survey of HV/MV power cables eliminates risk of unplanned outages
- Precise PD localisation (within 0.2% of cable length) minimizes maintenance expenditure
- Higher ROI by appropriate risk assessment and prioritisation of cable sections for repair / replacement
- Online PD measurement services without disrupting plants or facilities
- Worldwide presence of engineers provides cost effective and quick PD survey
- Greater emphasis on health and safety provides assurances for safe and reliable surveys of power cables

Product Summary

Description Qualitrol is a trusted name in providing PD monitoring and analysis products and services to utilities. Our expert diagnostic and testing services include the following:

- On-line PD measurement at HV/MV power cables
- PD fault localisation within accuracy of 0.2% of the total cable length
- Reports on all measurements with expert advice
- On-site customer training on PD measurement
- Expert consulting services during acceptance testing and maintenance planning

Application Qualitrol provides a large pool of highly experienced engineers to diagnose and test HV/MV power cables during:

- Commissioning and acceptance testing
- Period online inspections to assess cable health
- Identifying the fault location on weakening cables
- Factory acceptance testing



Ensuring quality of assembly work and reliable continued operation of power cables

- Failure in cable insulation is generally preceded by partial discharge and subsequent degradation phase
- Detecting partial discharge at the early stage of degradation helps in preventing sudden failure
- Qualitrol experts make sure that there is no PD in the installed power cables
- Detailed report on power cable health assessment with recommended actions

Highly accurate periodic PD survey of HV/MV power cables eliminates risk of unplanned outages

- HFCTs used in the systems are sensitive to a wide range of frequency (100 KHz - 200 MHz)
- TEV sensors to differentiate between PD and local discharge (Corona, surface discharge)
- Advanced de-noising based on proven noise gating technology - Wavelet Filtering
- Option for using UHF sensors to differentiate Cable PD from local discharge
- Reports proposing follow-up testing schedule to minimise the risk of cable failure

Precise PD localisation (within 0.2% of cable length) minimizes maintenance expenditure

- Highly accurate location algorithms based on "Time Domain Reflectometry" (TDR)
- Higher acquisition rate and dynamic threshold selection improves definition on PD events
- Transponder is used for longer cables to improve the accuracy of location
- More than 25 years of experience in PD analysis into HV apparatus

Higher ROI by appropriate risk assessment and prioritisation of cable sections for repair / replacement

- PD trending and other statistical parameters helps in risk assessment of operate vs. replace
- Environmental, and economical factors considered while prioritising the cable sections for repair / replacements
- Survey reports provide recommendations for prioritizing replacement or corrective actions

Online PD measurement services without disrupting plants or facilities

- HFCTs can be clamped on the energised cables
- TEVs can be put over the compartment anytime (even when the cables are operational)
- HFCTs are passive and do not have any impact on the electric field of cable
- Easy to connect with the data acquisition unit and analysis system

Worldwide presence of engineers provides cost effective and quick PD survey

- More than 50 field service staff located in all major countries
- Guaranteed turn around within 2 days
- PD survey done by engineers who know English and local languages
- Online support by researchers and experts from Qualitrol DMS Glasgow

Expert power cable condition assessment...

Greater emphasis on health and safety provides assurances for safe and reliable surveys of power cables

- Separate health and safety document for PD measurements on-site and at factory
- Periodic update to health and safety documents and training to survey engineers
- Survey does not use any over-voltages; hence not exposing the power cables to higher voltage stresses
- No PD measurement without comprehensive review of line diagram, physical cable systems and all safety standards

Other key benefits

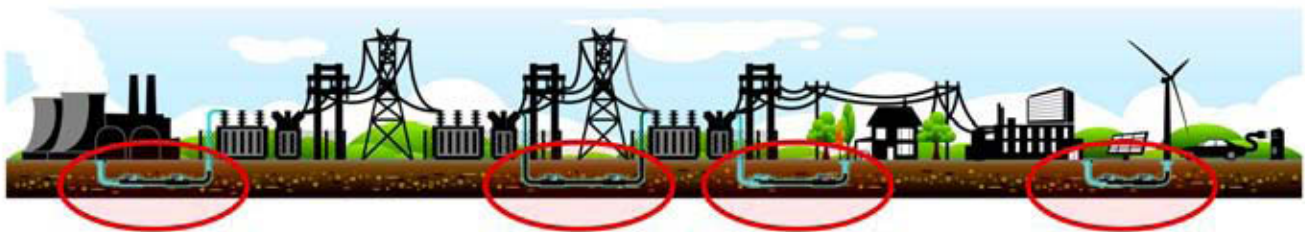
- Rugged and reliable PD monitoring system
- Superior system protection under high voltage conditions
- Real-time monitoring of events

Why partial discharge measurement in power cables?

- Failure in cable insulation is generally preceded by a degradation phase which may last for months or several years
- Any insulation degradation results in the inception of partial discharges (PD) at degradation site(s)
- PD analysis and localisation helps in determining the insulation health and subsequently the life of power cables

Why QUALITROL Expert diagnostic and testing services?

- More than 25 years of experience in providing PD monitoring systems and services to utilities across the world
- World wide presence provides quick turn around times
- Long term serviceability assurance helps in formulating longer service contracts
- Cross team integration increases the accuracy of results and confidence of operator / asset manager
- Highly accurate PD detection and localisation system for power cables
- Greater emphasis on health and safety during PD measurements surveys



...from the world leader in PDM



System overview

Sensors

- HFCT sensors detect the high frequency signals induced from any PD pulse inside the cable insulation and send to data acquisition unit for further analysis. TEV sensors are used to detect the corona and surface discharge. It helps in differentiating PD activity inside the insulation from corona and surface discharge

Data Acquisition Unit (scope)

- The DAU takes the signal from sensors and applies filtering and noise gating to reject interference. The digitised high frequency pulse is then sent to the Analysis System for further analysis

Analysis System

- The PD analysis system determines if the high frequency signal is a PD signal or not. It stores all PD signals with their parameters for trend analysis. The PD analysis system also locates the fault along the cable with an accuracy of less than 0.2% of the total cable length

Transponder

- The Transponder is used for PD localization in cases of long cables > 3 km (1.8 miles). It injects the pulse back after receiving the actual PD signal in order to make comparison simpler for the system

The measuring method

- Qualitrol system experts are capable of detecting and locating partial discharge in all kind of HV/MV cables:
 - XLPE / PVC, EPR, PILC / MIND / LPOF and CLX Armored Cable
 - Single core and multi core cable
 - Cables of any length or any number of joints
- PD measurements are made using HFCT and TEV/UHF sensors that are clamped over the earth screen. HF Signals are captured synchronously enabling the test engineer to observe phase-related patterns of discharge, online and in real-time
- The expert Analysis System provides an automatic PD detection and criticality level for the cable based on magnitude and number of PD pulses per power cycle. Qualitrol experts and the PD analysis system together are capable of differentiating PD activity from external noise and local discharges, e.g. corona, surface discharge, switchgear PD, etc
- The “Time Domain Reflectometry” (TDR) algorithm is used to accurately locate the PD to an accuracy of less than 0.2% of the cable length
- The Transponder is used at the other end of the cable section to keep the similar accuracy of localisation in the longer cable sections (greater than 3 km)

Site survey and PD measurements

- The site visit for a PD survey is performed by our highly experienced technical staff. PD measurements are performed only after reviewing an up-to-date electrical single line diagram and physical checking cable systems, including splices and terminations
- All PD measurement and analysis is done as per the test plan already written for the site
- Written expert reports are provided after all surveys / PD measurements. The reports typically contain:
 - Information about the test results in the form of PD magnitude, statistical parameters and PD location for each cable
 - The condition of tested cables and accessories with recommended actions for all
 - Recommendations for prioritizing replacement or corrective actions
 - Proposed follow-up testing schedule



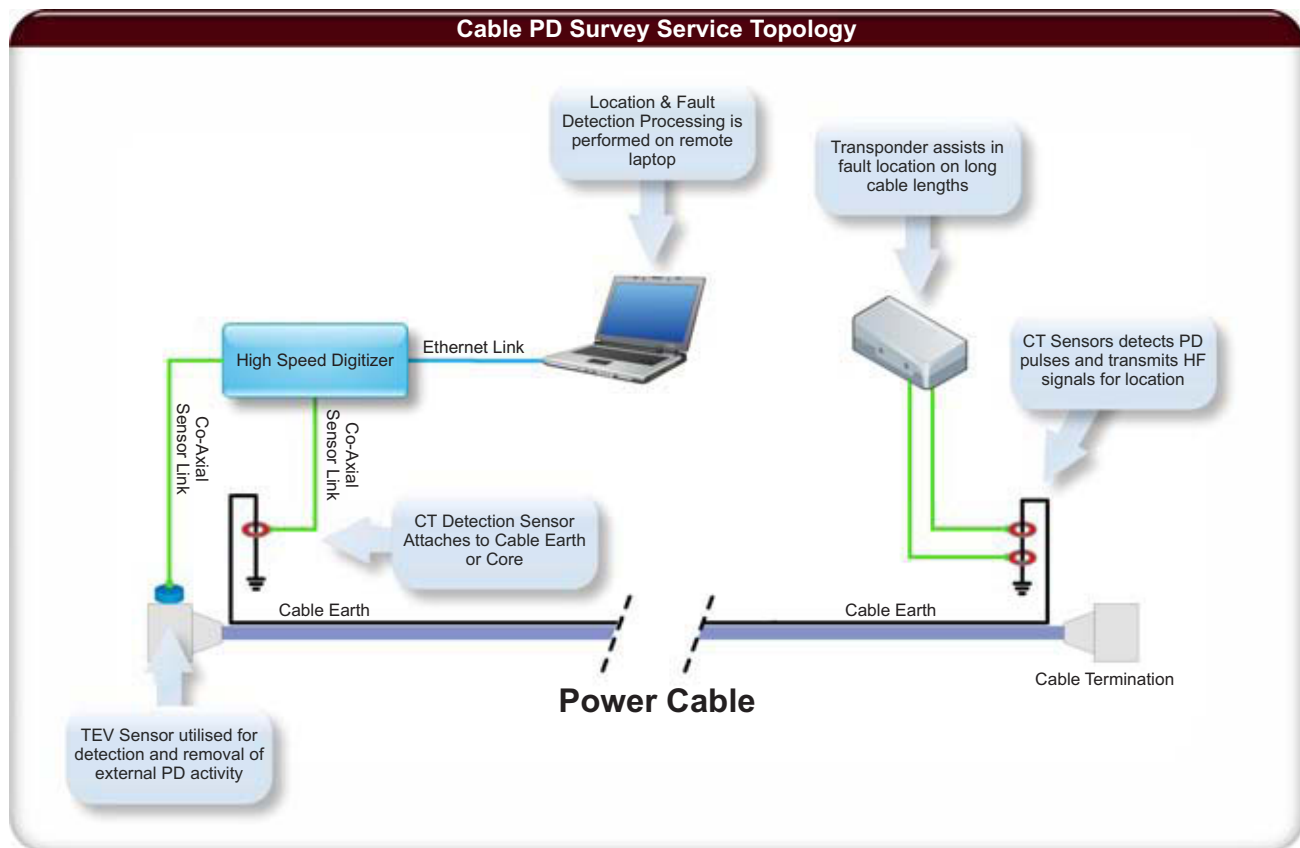
System components

A typical PD survey system consists of:

- HFCT sensors, one for each power cable)
- TEV sensors, one for each metallic cabinet terminating cables
- DAU, one oscilloscope to connect four sensors
- Laptop with PD analysis system installed
- Co-ax cable to connect sensor to DAU
- Communication cable to connect DAU to Analysis System laptop
- Power cables to supply powers to DAU and laptop

Optional components include:

- 1 Transponder, when the cable length is more than 3 km (1.8 miles)
- 1 UHF sensor, to differentiate local discharge from PD inside the cable insulation





Power Cable PD

Minimize cable maintenance expenditure



- Online PD measurement at power cables without disrupting plants / facilities - offline factory testing
- Excellent interference immunity for PD measurement under difficult conditions
- Highest level of reliability of PD inspection
- Highly accurate fault location and PD severity analysis
- Power cables are not exposed to higher voltage stresses
- PD measurement and analysis by highly experienced engineers
- Unbiased diagnosis and assessment of critical power cables
- Expert consulting services during acceptance testing and maintenance planning
- Service contracts - Long term PD survey and measurements
- Overall insulation health assessment and extension of life time of power cable

About QUALITROL®

Established in 1945, with continual improvement at the core of our business, QUALITROL® provides smart utility asset condition monitoring across the globe. We are the largest and most trusted global leader for partial discharge monitoring, asset protection equipment and information products across generation, transmission and distribution. At QUALITROL® we are redefining condition monitoring technology for Electric utilities assets.

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