Turn key condition monitoring solution to prevent costly failures and extend asset life of transformers

- Accurate and early incipient fault detection ensures reliable operation and reduces supply outages
- Creates highly accurate reports on asset condition hence reduces maintenance cost
- Monitors multiple transformers simultaneously resulting in higher return on investment
- Robust design and excellent interference immunity for measurements under difficult environmental conditions

**Product Summary**

**Description** The 609 PDM system is an on-line partial discharge (PD) monitoring system for power transformers, based on industry accepted UHF technology.

**Application** The 609 PDM is used to continuously assess the performance of insulation in a power transformers so that corrective actions can be taken before any failure occurs. The information gained from the system is used for condition based maintenance decisions to optimise maintenance expenditure.
QUALITROL 609 PDM Transformer partial discharge monitor

**Turn key condition monitoring solution to prevent costly failures and extend asset life of Transformers**

- The 609 PDM is a complete PD monitoring package that includes sensors, cables, data acquisition unit, processing unit (CPU) and software
- Commissioning, training and diagnostic services through our expert engineers and researchers
- Condition monitoring of insulation of power transformer whilst asset is still in service
- Calibration facility for sensors to verify proper operations

**Accurate and early fault detection ensures reliable operation and reduces supply outages**

- Outstanding sensitivity and accuracy (-75 dBm) of UHF measurements
- Built-in sensitivity of -75 dBm enables better PD analysis
- Wide bandwidth of 300 to 1500 MHz
- Higher sample resolution (256 samples per cycle) improves definition of PD events
- Amplitude comparison helps in approximate localisation of PD fault
- Easy alarm setting configurable for each channel separately

**Creates highly accurate reports on asset condition hence reduces maintenance cost**

- Integrated Reporting: Need based customizable reports created automatically in a single document
- Flexible PD event visualization, including PRPD (Phase Resolved Partial Discharge), PRPS (Phase Resolved Pulse Response), POW (Point on Wave) and STT (Short Term Trend)
- PRPD recording facility helps in analyzing historic data
- Fast and easy access of data in generating reports

**Monitors multiple transformers simultaneously resulting in higher return on investment**

- Suitable for 1 to 24 channels depending on the transformer location and monitoring sensors per transformer
- External OCUs can be connected to the same 609 base unit
- No need for any additional cabinet, CPU and software

**Robust design and excellent interference immunity for measurements under difficult environmental conditions**

- Rugged sensors and connectors with IP66 rating
- Built-in display and remote client enable safe operations in difficult environmental conditions
- Noise gating by external signal antenna (optional)
- Transient protection for each channel

**Advanced HMI provisions (intelligent data handling, display and interpretation)**

- Built-in LCD screen with touch screen based interface
- Automatic self-check of PDM with faults logged and alarmed
- 2D and 3D display of PD signals in multiple formats (PRPD, PRPS, POW and STT)
- Trend analysis facility on stored PD data
- Self-test functionality for each channel saves time in diagnosing system fault
- Export functions for PD results / reports
- Remote client interface with integrated software to view, analyse and display PD events and trending

**Qualitrol Expert PD analysis services**

- Highly experienced and industry known experts to analyse PD events
- PD analysis report (on demand) prepared by Qualitrol experts
- Support available on system installation, testing and PD analysis

*Turnkey condition monitoring solution...*
**Flexible installation and configuration options to meet customer expectations**

- Very rapid and easy deployment
- Sensors can be fitted to available inspection hatch, drain valve or manhole as retrofit
- Easy configuration of system (offline / online) using touch screen interface
- Required modules and features already installed into the system
- Support to multiple operating systems (Windows XP, Windows 7)

**Smart and quick real time alarming / alerting mechanism**

- Easily programmable alarm criteria and rule engines
- Hardwired alarms for SCADA and local user interface
- Real-time monitoring of events with time accuracy of 1 millisecond
- Facility to alert through SMS, email, IEC 61850, substation RTU

**Remote monitoring and configuration**

- Secure client interface provides functionality to monitor and archive alarms and event information
- Facility to configure system remotely
- Multiple communication methods (Ethernet, RS-485, RS-232)
- Built-in support for Modbus, DNP3.0 and IEC 61850 protocols

**Expandable and field upgradable without reconfiguration**

- Designed for future expandability and ability to take inputs from sensors with 4 - 20 mA output
- 16 GB SLC SSD storage capable of being upgraded if required
- Supports addition of future client applications
- Easily changeable front panel alarm layout

**Other key benefits**

- Designed to meet highest security standards, including NERC cyber-security standards
- Built-in time synchronization through NTP/SNTP

**Why UHF (Ultra High Frequency) technology?**

- UHF technology is industry proven technology for online monitoring of partial discharge in insulations of HV apparatus
- The sensitivity is higher than any other kind of PD measurement e.g. DGA, Acoustic, or conventional measurement
- Immediate detection of partial discharge makes it ideal for online monitoring and detects PD earlier than DGA (Dissolved Gas Analysis)
- Excellent interference immunity compared to acoustic and conventional measurements

**Why Qualitrol DMS?**

- Qualitrol DMS is the pioneer in UHF based PD measurement technology
- Qualitrol DMS has more than 20 years of experience in supplying UHF based PD monitoring systems to utilities across the world
- Proven and tested hardware and software systems for more than 20 years
- Industry known expert service in PD analysis and reporting
- Long term serviceability assurance and upgrade options to the 609 PDM system

...from the world leader in PDM
QUALITROL 609 PDM Transformer partial discharge monitor

System components

**UHF sensor (coupler)**
- UHF sensors are the key components of any PDM system. They capture the UHF signals induced from PD pulse and send to the data acquisition system for interpretation.
- The 609 PDM can be connected with any available UHF sensor (internal, window or drain valve sensor). The system can be scaled from one sensor to 24 sensors.
- In new transformers the sensors are usually fitted internally, inside the tank wall (internal sensors). They act as antennas picking up UHF signals induced from PD. Complete protection for sensitive electronics of the 609 PDM is assured by fitting an external DMS protector which shunts dangerous voltages to earth.
- For retrofitted systems, external sensors are fixed in either hatch covers or drain valve.
- Qualitrol DMS can custom-design all types of UHF sensors for particular applications and calibrate them to ensure they meet the users specification for sensitivity and bandwidth.

**Optical Converter Unit (OCU)**
- Each OCU takes the signal from the UHF sensors and applies filtering to reject interference (noise) that can result from broadcast signals, discharges in nearby air-insulated equipment and other sources. The characteristic of the UHF pulse is then sent to the Equipment Cabinet.
- Additional fibres within the cable are used for OCU control and to initiate an integrated self-test procedure that automatically checks and logs the condition of each channel.
- The OCUs are totally protected against high-voltage transients and are suitable for use in harsh environments.

**Equipment Cabinet**
- The Equipment Cabinet consist of central processing unit (CPU), switch to connect OCU and inputs for 4 - 20 mA signal. It also has an option to include an OCU in the box.
- Embedded processors format the data and provides a real-time display of the partial discharge activity.
- The CPU receives the optical data streams from the OCU’s and transmits control signals back to the OCU (i.e. for the self test).
Data handling, display and interpretation

- All single-cycle event data gathered by the sensors is automatically analyzed by a range of sophisticated software and display logics to identify the PD. At the same time, sources of interference such as lights, radar, mobile phones, motors, etc, are rejected.

- The 609-PDM system operates simultaneously in different modes and will capture isolated PD events even while displaying the current on-line data. The data can be viewed in a number of ways including POW, PRPD, PRPS, and STT format to give an instant impression of the PD characteristics.

- For the remote operation of the system, a duplicate PC, modem and LAN interface can be installed off-site. This enables the 609 PDM family to be operated, controlled and data received in a similar way to being present at the substation.

Key features

- 2D and 3D real time PoW, PRPD and PRPS data display and analysis
- 3D, real time single-cycle (PRPS) and PRPD display and analysis
- True PRPD, STT real time displays
- Periodic storage of point-on-wave displays for trend analysis
- Event Mode captures single events
- Data stored on hard disk for up to 10 years
- Automatic self-check of PDM with faults logged and alarmed
- Transfer of data to remote site by company LAN or Modem
- Programmable alarm criteria
- Warning of PD activity
- Alarm of high or increased PD activity
- Automatic communication of warning / alarm condition to headquarters PC
- Alarm notification using IEC 61850
- Automatic report generation (daily / weekly / monthly) as per customer needs

System software

High clarity PD analysis, easy configuration and operation of PD events and easy access to historical data.
QUALITROL 609 PDM Transformer partial discharge monitor

609 PDM architecture

Outline Of UHF Monitoring System for Single Transformer

SMARTSUB server connectivity for multi asset monitoring and 3rd party integration

Remote clients on LAN view extended interface

PD Monitoring Cabinet

SmartSUB Server

Station Control System

609 PD Panel mount
Responsible for the capture, processing and analysis of PD data supplied by the OCU units.

Support:
- Local and remote client operation
- IEC 61850, DNP3.0 system data output
- Storage for up to 10 years data
- Common client for all solutions

UHF sensors / couplers (internal, external, or drain valve sensors)

1 OCU that can support 1 to 6 sensors

609 main panel including central processing unit (PD monitor)

PD analysis and reporting software

Optional:
- External OCUs that can support 1 to 6 sensors each
- Independent system enclosure for 609 base unit and one OCU
- 1 Ethernet switch (fiber-optic or copper) for each external OCU

609 PDM architecture

A typical 609 PDM system consists of:

- UHF sensors / couplers (internal, external, or drain valve sensors)
- 1 OCU that can support 1 to 6 sensors
- 609 main panel including central processing unit (PD monitor)
- PD analysis and reporting software

Optional:
- External OCUs that can support 1 to 6 sensors each
- Independent system enclosure for 609 base unit and one OCU
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609 PDM - full after sale support

Commissioning and calibration

- Qualitrol provides additional service and tools for calibrating sensors and commissioning the PD monitoring system
- Our staff can install, calibrate and verify proper operation of the system
- We also provide training to customer’s staff on how to operate and maintain the system
- After installation, Qualitrol also provides assistance in setting up the configuration e.g. alarm limits, noise gating, drawing layout diagrams into the system etc

Training and Expert service

- Qualitrol DMS provides a training course to customers on PD measurements, analysis and how to operate and maintain the 609 PDM system
- Additional training programs are also organised for all customers to make them aware about PD measurements and analysis using our products
- Qualitrol DMS also provides detailed PD analysis service by its highly experienced and industry known experts on UHF technology. PD analysis reports can be made available periodically (on demand) based on the PD event data received from the field
## TECHNICAL SPECIFICATIONS

### Power supply
- **Voltage range:** 90 to 264 V AC; 47 to 63 Hz
- **Supply power:** 70 W
- **Local MMI interface:** 5.7” resistive touch
- **Output:** Three SCADA / SCS alarms contacts: PD Warning, PD alarm, System Fault
  - Ethernet, IEC 61850
  - 12 x LED status indicators (bi-colour)

### MCU (Optical Converter Unit)
- **Input (UHF):** Supports 1 to 6 UHF channels for UHF sensor inputs
- **Input (noise):** 1 separate noise channel for external noise antenna
- **Dynamic range:** -75 to -35 dBm (logarithmic)
- **Sample rate:** 15360 samples/s per channel at 60 Hz

### UHF sensors
- **Mounting:** Internal or External
- **Output:** Coaxial Analog output (N-Type)
- **Bandwidth:** Wideband 200 - 1500 MHz
- **Sensitivity:** < 5pC

### Noise sensor
- **Gating antenna:** 100 - 3000 MHz

### 609 Base Unit PC
- **Memory:** 2 GB, Upgradable (if required)
- **Minimum size for installation:** 20 MB
- **Data storage:** 16 GB
- **Clock:** 1.6 GHz
- **Interference filtering:** Gating, bandpass filtering, software filtering
- **Reporting:** Daily, weekly and monthly reports

### Panel PC
- **Ethernet ports - external:** RS-232, RJ45 (10/100 Mbps)
  - Optional RS-485 (full duplex and half duplex)
- **USB:** One port to facilitate firmware upgrade, configuration upgrade and manual download of data
- **Protocols:** Ethernet / serial; Modbus (serial); IEC 61850

### HV testing
- **Compatible:** Ability to monitor and record PD during testing

### Environmental
- **Ambient operating temperature:** -45° to +55°C [-49° to +131°F]
- **Storage temperature:** -25° to +85°C [-13° to +185°F]
- **Humidity:** 5 - 95% non-condensing
- **Enclosure rating:** IP66
- **Seismic:** IEEE C37.98 (seismic testing of relays)
- **Environmental test compliance:** BS EN60068-2-2, BS EN60068-2-27, BS EN60068-2-29
- **Vibration test compliance:** BS EN68-2-6, BS EN68-2-27, BS EN68-2-29

### Immunity
- **EMC test compliance:** Conforms to relevant specifications for monitoring / control equipment in HV substations.
  - BS EN55022 (2006); BS EN61000-3-2 to -3-3, BS-EN61000-4-2 to -4-6, BS EN61000-4-8, BS EN61000-4-11, BS EN61000-4-18; IEC 60255-5, IEC 61180-1
- **Others:** EMI / RFI immunity

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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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