SmartSUB

Substation condition monitoring

Continuous, real time condition monitoring of **ALL** substation assets

- **Fully modular, flexible and secure system**

- **Achieve greater grid reliability**

- **Significantly reduce utility Operations and Maintenance (O&M) costs**

- **Make more effective and efficient decisions in real time**

Product Summary

Description Condition based monitoring system of substation assets, through combination of Intelligent Electronic Devices (IEDs), smart sensors, fully secure comms / open protocols and 'intelligent' head end user friendly software

Application Real time monitoring functions include:

- Partial discharge in transformers, GIS, bushings, CTs and cables

- Temperature, pressure, flow and liquid levels of oil in transformers

- Moisture levels, dissolved gas analysis, cooling performance, load tap control, fault location and loadings on transformers

- Breaker, bushings, batteries, MV panels, capacitor bank, surge arrestor, reactor and protection system condition monitoring

- SF6 gas density, cable temperatures and much more….
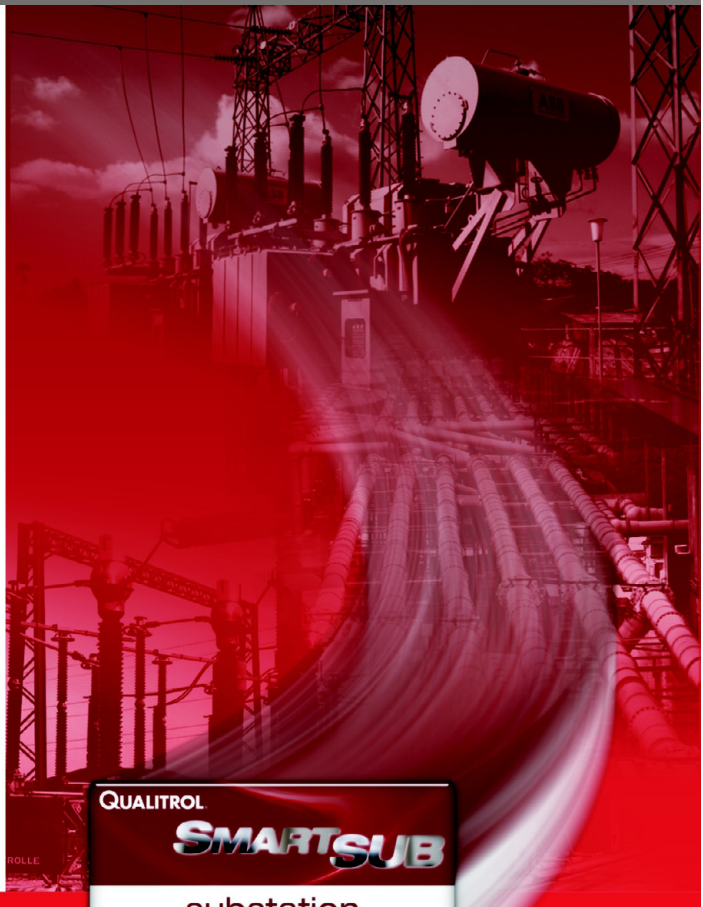
QUALITROL

SMARTSUB

substation condition monitoring

QUALITROL®

Defining Reliability

SMARTSUB Substation condition monitoring

Continuous, real time condition monitoring of ALL substation assets

- Online monitoring of substation assets providing real time information on both the current condition as well as historic trends
- Asset condition monitoring can include transformers, GIS / breakers, load tap changers, cables, batteries, bushings, CTs, protection relays, reactors, etc
- A complete one-stop shop solution for substation condition monitoring

Fully modular, flexible and secure system

- Sensor technologies and monitoring parameters can include all / any of the following:- partial discharge, oil temperature, oil pressure, vibration, oil levels and flow, moisture levels, SF6 gas density, dissolved gas analysis, analogs and switches, cooling, arc location, timings, etc
- Flexibility to monitor a mixture of currently installed and new / retrofitable IEDs and sensors
- Best in class approach by integrating QUALITROL / 3rd party IEDs and sensors
- Customize a solution to suit the overall utility needs or combine high specs in critical substations with medium specs elsewhere
- Open protocols (for full interoperability) including IEC 61850, IEC 60870, DNP 3.0 and Modbus, together with shared real time comms - offering full scalability
- High level cyber security (in line with NERC CIP security standards)

Achieve greater grid reliability

- Prioritize maintenance on assets showing trends towards near term failure - *catch it early!*
- Fewer outages achieved through ability to reduce asset failures and their resulting unexpected trips, as consequence of monitoring condition and trends in real time
- Improve SAIDI / CML through reduction in outages
- Optimize asset utilization and monitor effect on changing loads in real time

Significantly reduce utility Operations and Maintenance (O&M) costs

- Reduce maintenance costs via move to condition based maintenance - only service and maintain an asset when it needs it
- Extend asset lifetime as a result of real time condition monitoring (avoid catastrophic failures and collateral damage) thus reducing capital replacement costs
- Minimization of asset overhauls when unnecessary can avoid issues arising from the associated service and maintenance effort
- Achieve more efficiency with reduced maintenance manpower levels
- Reduce fines and lost load payments through reduction in unexpected trips
- Make corporate efficiency savings through improved management tools
- Improved safety for workforce and improved customer service via better power quality

Make more effective and efficient decisions in real time

- Centralized 'intelligent' asset condition management system, offering fast and reliable data acquisition and providing *information* not data
- Ability to analyze assets across a wide range of monitoring techniques to get more accurate picture of condition trends and predicted estimate of failure
- Automatic expert analysis of key data for faster diagnosis
- Predictive tools for asset life expectation and condition based risk management
- Sophisticated modelling and simulation tools for asset performance optimization
- SMS / Email / Web / GUI based alarms, warnings and reporting available
- Integration with other systems including SCADA, PI/EMS, resource management tools, etc
- ICON driven user friendly interface, with full asset based visualization tools, for ease of use by management as well as departmental experts
- Multiple languages available
- Automatic reports for management
- Ability to integrate offline data into system e.g., IR scans and portable recordings
- Historic database of all condition based data / information
- Web based solution for intranet access without need for proprietary software

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Defining Reliability

QUALITROL SMARTSUB - asset monitoring protection matrix

Monitoring Parameter	Assets										
	Transformer Reactor	Load Tap	Bushings	MV Panels	GIS / GIL	Breaker	Instrument Transformers	Cables	Protection	Surge Arrestor	Batteries
Partial discharge	✔		✔	✔	✔		✔	✔			
Tan delta / dielectric loss angle			✔				✔	✔			
Oil or ambient temperature	✔	✔									
Differential temperature	✔										
Heated well temperature	✔										
Direct winding temperature	✔										
IEEE winding temperature	✔										
Oil and liquid levels	✔	✔									
Liquid flow	✔	✔									
Tank pressure - static	✔										
Tank pressure - rapid rise	✔	✔									
Tank pressure - relief	✔	✔									
Cooling fans	✔										
Cooling pumps	✔										
SF6 gas density	✔ 1				✔	✔ 2	✔ 3				
Gas accumulation	✔										
Dissolved gas analysis	✔	✔									
Moisture	✔				✔	✔					
Switches (on/off, open/closed)	✔	✔		✔		✔			✔	✔	✔
Motor characteristics	✔										
Analog loads (volts or currents)	✔	✔	✔	✔	✔	✔	✔		✔	✔	✔
Mechanical movement		✔				✔					
Vibration	✔										
Fault location	✔				✔			✔			
Optical temperature								✔			
Very fast transients	✔		✔		✔						
Frequency response	✔										
No. of operations		✔		✔	✔	✔				✔	
Time	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔

1 Gas insulated transformers
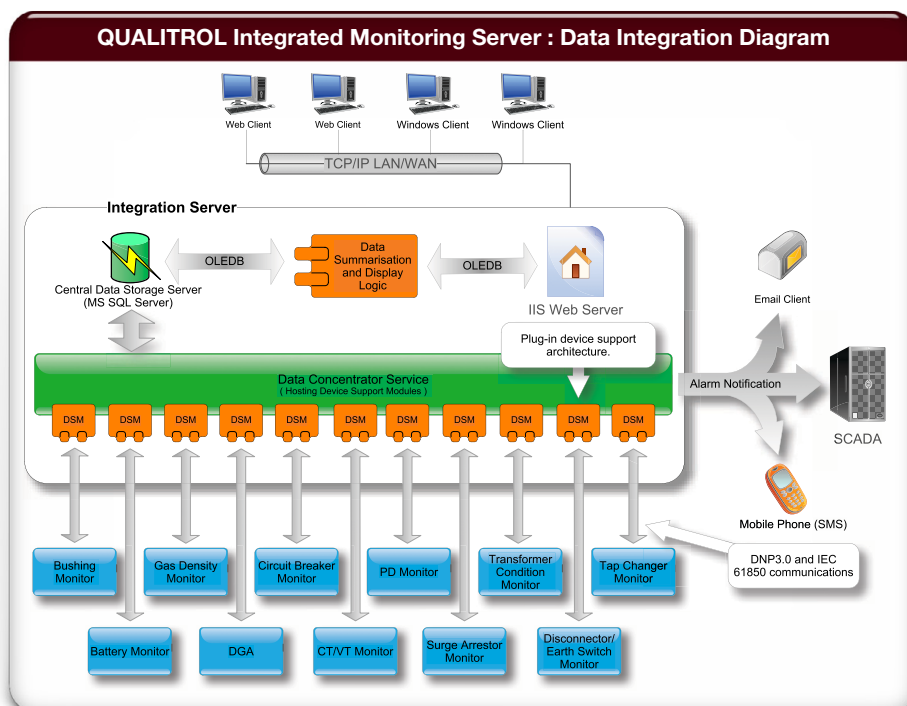2 Gas insulated breakers
3 Gas insulated CTs

"Research by KEMA indicates that for the existing North American and European electrical infrastructure, more than US$3 billion could be saved on maintenance costs and postponed investments, within the first 10 years of introducing condition based maintenance programs...."

"....in support of this claim several utilities around the world that have trialed condition based maintenance programs are achieving as much as 14%-18% reduction in maintenance costs."
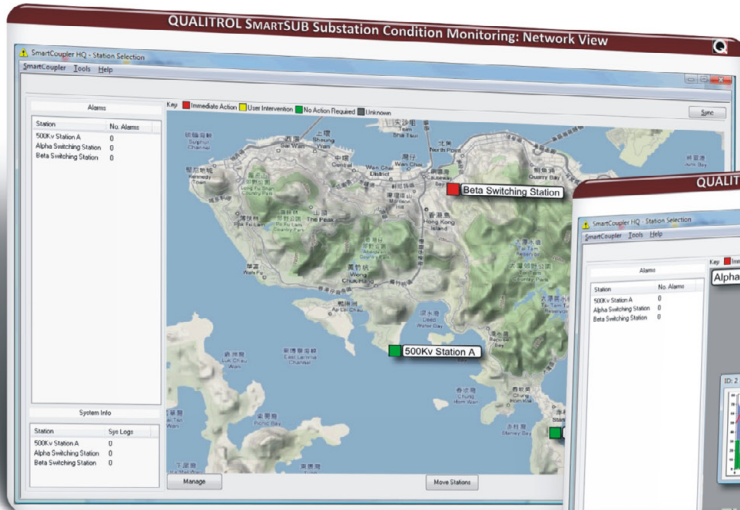
An example of one of many variations of a QUALITROL SMARTSUB system architecture

Note: Any setup is available, depending on utility monitoring and communication needs

QUALITROL Integrated Monitoring Server : Data Integration Diagram

Web Client | Web Client | Windows Client | Windows Client

TCP/IP LAN/WAN

Integration Server

Central Data Storage Server (MS SQL Server)

OLEDB

Data Summarisation and Display Logic

OLEDB

IIS Web Server

Plug-in device support architecture.

Email Client

Alarm Notification

SCADA

Mobile Phone (SMS)

DNP3.0 and IEC 61850 communications

Data Concentrator Service (Hosting Device Support Modules)

DSM DSM DSM DSM DSM DSM DSM DSM DSM DSM DSM

Bushing Monitor | Gas Density Monitor | Circuit Breaker Monitor | PD Monitor | Transformer Condition Monitor | Tap Changer Monitor

Battery Monitor | DGA | CT/VT Monitor | Surge Arrestor Monitor | Disconnector/ Earth Switch Monitor

Example screen shots from the QUALITROL SMARTSUB 'intelligent' condition monitoring system

◄ Google™ Earth style view of utility network and substations - flashing alarms at substation position notify user to zoom in for more details
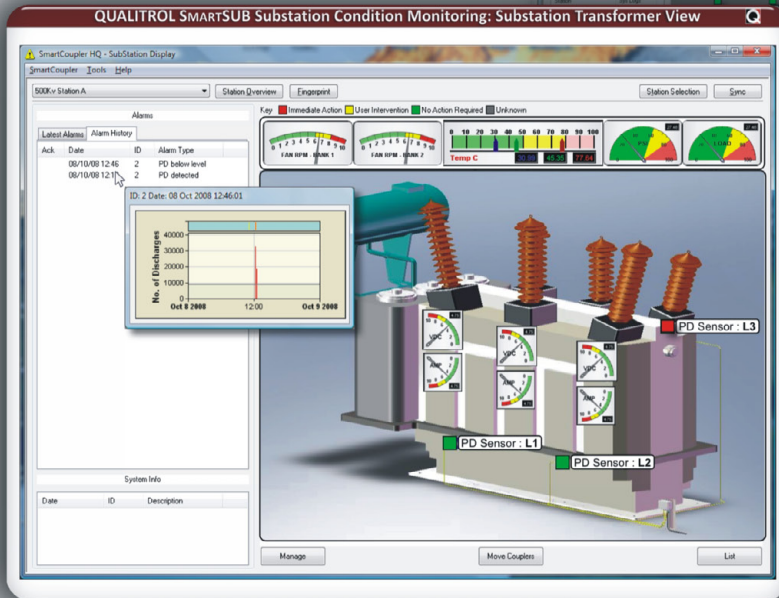
▲ Partial discharge event view in a GIS

◄ Integrated partial discharge, DGA, temperature, pressure, load and cooling monitoring on a transformer

About QUALITROL®

QUALITROL® manufactures substation and transformer monitoring and protection devices used by electric utilities and manufacturing companies. It is the global leader in sales and installations of transformer asset protection equipment, fault recorders and fault locators. Established in 1945, QUALITROL® produces thousands of different types of products on demand, each customized to customers' unique requirements.

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