Power PD Monitoring System

PowerPD, Inc.

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On-line monitoring of power transformers and associated accessories is becoming an essential feature of the electric utility systems of the future.

The justification for on-line monitoring is driven by the need to increase the availability of power transformers, re-direction of time and/or operational-based maintenance to condition-based maintenance, asset and life management; and failure cause analysis.

Functions

- Continuous Data Acquisition, Storage, Diagnostic
- PD & Corona Detection Device Interface
- Dissolved Gas Analysis (DGA) Device Interface
- Tap Changer Interface
- Bushing Monitor Interface
- Over Load Capability
- Insulation Moisture
- Load & Fan, Pump, OLTC Motor Current Monitoring
- Calculation Winding & Hot-Spot Temperature
- Expert Cooling Control
- Alarm/Event Logging
- Life Management
- Failure Cause Analysis
- Modbus, DNP, IEC61850, IEC60870-101/104 Interface

"A Complet PDMS will help prevent eauipment failures."

Some events lend themselves to an economic analysis:

- Reduced inspection and maintenance costs
- Reduced failure-related repair or replacement costs
- Improved real-time transformer loading capability
- Deferred upgrade capital costs due to load growth
- Deferred replacement capital costs due equipment age or condition

There are also a number of other benefits that are tangible but cannot be quantified easily:

- Enhanced system reliability and availability with fewer unplanned outages
- Improved planning for scheduled outages by using remote equipment condition assessment to avoid additional outages
- Enhanced financial results with performance-based regulation
- Optimized design and operating practices
- Reduced commissioning costs
- Increased equipment life
- Enhanced personnel safety
- Improved environmental safety
- Retained knowledge of most skilled staff (expert system)
- Improved system-wide access to key knowledge using Web tools

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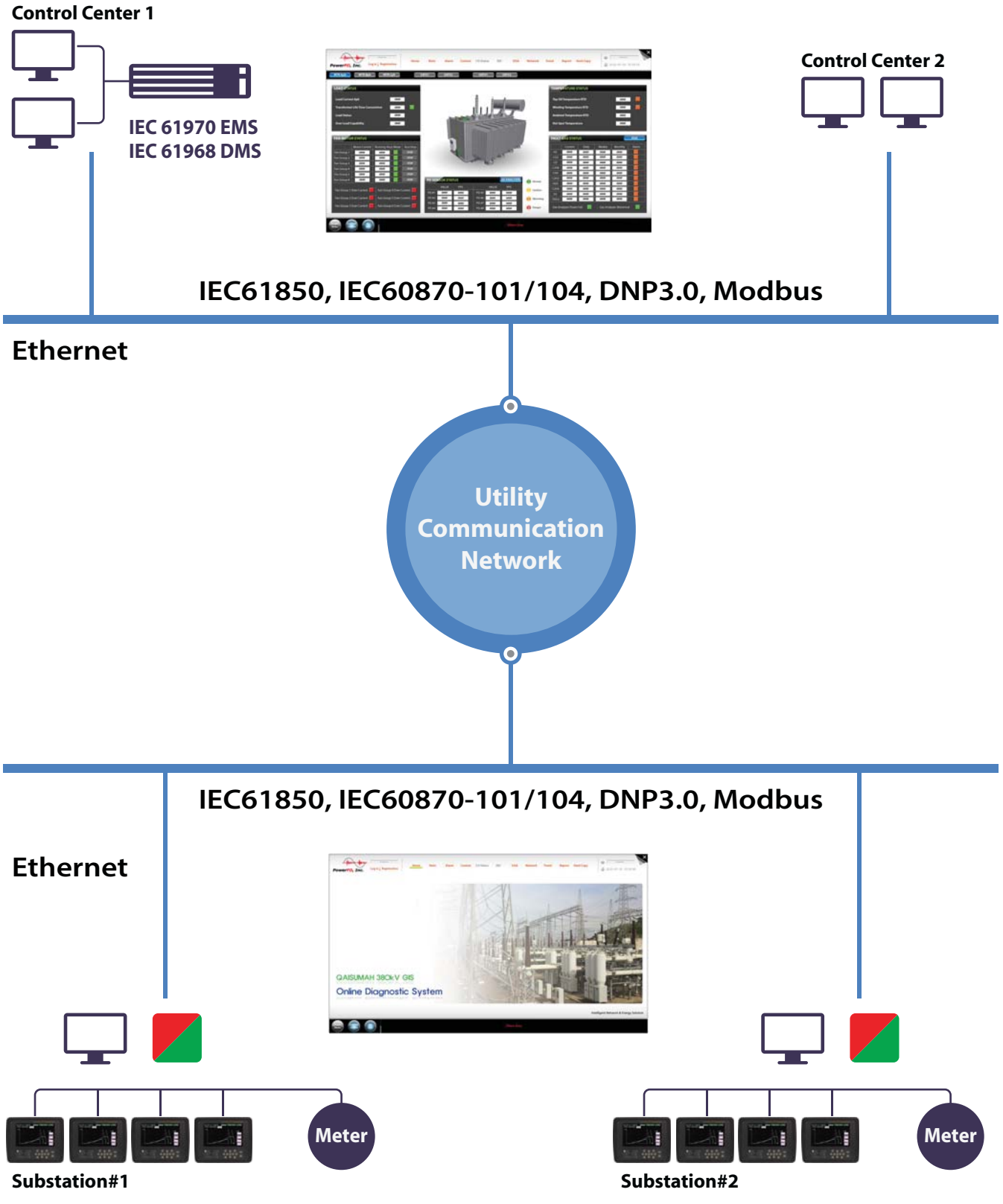
The HMI Solution is offered for transformer diagnosis System connected SAS, SCADA, DCS, ECMS those are Suitable for various global standard



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- 2channels Redundant Fiber Optic Ethernet Port
- Enough Communication channels for PD, DGA, Bushing, Fiber Optic Temperature Monitoring
- Meter function for Rated current/voltage, Fan/Pump/LTC Motor current/voltage
- Multi Source Interface through Analog Input, RTD Input
- 16channel Digital(Binary) Inputs for transformer status monitoring
- Digital(Binary) Output for Fan/Pump Control and Alarm Indicates

A SD Card

- Data Logging
- Standard 8GByte
  (Option)up to 32Gbyte

B Fiber Optic

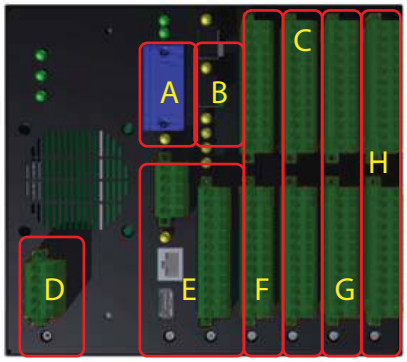
- 2Chnnel Ethernet
- IEC61850/60870
- DNP3.0
- Modbus

C Digital Input

- 16Chanel
- AC/DC Free Contact Voltage
  (Over 80Vac/dc)

D Power

- 80~264Vac, 50/60Hz
- 100~300Vdc



H Digital Output, RTD, LTCR

- 4 Digital Output(Dry Contact)
  Cooling Control, Alarm
- Isolation 4Chennel PT100Ω Input
- Isolation 1Chennel OLTC tap position
  resistance Input

E Communications

- Isolation RS-485 7Chennel for DGA,
  Bushing, PD, F/O Temperature,
  etc sensor interface
- TCP/IP RJ45 Ethernet 1Chennel
- USB 1Channel for Remote update with
  CDMA, GSM Modem (Option)

F Voltage/Current

- 2Chnnel 110Vac voltage sensing
- 8Chnnel current sensing for load
  & motor current

G Analog Interface

- Isolation 9Chennel 4-20mA Input
- Gas Sensor Interface
- Fiber Optic Temperature Sensor Interface
- Oil Temperature Interface
- Pressure Interface
- 2 Channel 4-20mA Output
  (Oil & Winding Temperature Output)

Item		Point	Remark
Communication	F/O Ethernet	2	
	RS485	7	
Input	AC Voltage	2	R, S, T or Motor
	AC Current	8	R, S, T, N or Motor
	DI	16	Dry Contact
	AI 4 – 20mA Input	9	
	RTD(PT100 ohm) / LTC Tap Position Resistance	4/1	
Output	DO Relay	4	
	AO 4 - 20mA	2	

Expert provides powerful features of PDMS.

<DGA Trend Line Analysis>

By the prediction of DGA Trend, it can overcome weakness that existing dissolved gas analysis had.

- Many global standards make the alarm if the values exceed limits specified value, but this is not enough to prevent transformer problems in advance.
- By trend line, user can know current and future status of transformer intuitionally.

<Duval triangle method>

- For DGA fault interpretations in power transformers is very simple (with three gases only) and consuming less time.
- This method has satisfied the fault diagnosis (both manual and software implementation) >95% accurate than any other method of diagnostics.
- Traces of one of the three gases can provide the quick fault diagnosis to a little experienced worker on the power transformers.
- This method always provides a diagnosis with a very low percentage of wrong diagnosis.

<Per Unit Life Time & Ageing Factor Calculation>

Using the IEEE Guide for Loading of Oil-Immersed Power Transformers C57.91-1995, one can thermally rate transformers beyond their nameplate conditions to a level that is safe for operation. Using the guide, engineers can establish continuous, emergency and short term emergency transformer ratings. Operators can use these ratings until the contingency conditions are mitigated. However, once the transformer has surpassed the short term emergency ratings, the transformer might reach critical temperatures and could possibly sustain damage. Protection engineers can avoid further transformer damage by using the thermal protection principles of the IEEE standard. The PDMS support the fundamental thermal principles of power transformers, philosophies of operations and the implementations of thermal protection.

Performance Test

- Power : AC 110V/0.3A, 220V/0.16A,
  DC 125V/0.22A(Nominal)
  < EUT Setting >
  - Rated Aux power supplied
  - CT : 5A supplied

- 1MHz burst immunity test
  < Test Specification >
  - Voltage rise time : 75ns
  - Oscillation frequency : 1MHz
  - Repetition rate : 400Hz
  - Output impedance : 200Ω
  - Relation to power supply : asynchronous
  - Polarity : positive, negative
  - Burst duration : not less than 2s each
  - Test voltage : common 2.5kV, differential 1.0kV

- Electrostatic discharge test
  < Test Specification >
  - Contact discharge : 8.0kV
  - Air discharge : 15.0kV
  - Number of discharge : 10 times each
  - Discharge interval : 1s

- Radiated electromagnetic field disturbance test
  < Test Specification >
  - Frequency : 80MHz ~ 1GHz, 1.4GHz ~ 2.7GHz
  - Modulation : 80% AM by 1kHz sine wave
  - Dwell time : 1s
  - Step size : 1% of fundamental
  - Field polarization : vertical and horizontal
  - Placement : 0.8m above GPR
  - Field strength 10V/m

- Electrical fast transient burst immunity test
  < Test Specification >
  - Voltage rise time : 5ns
  - Duration time to 50% peak voltage : 50ns
  - Burst duration : 15ms
  - Burst period : 300ms
  - Relation to power supply : asynchronous
  - Polarity : positive and negative
  - Test duration : 60s each
  - Test voltage Repetition rate : 4.0kV, 5.0kHz

- Surge immunity test
  < Test Specification >
  - Voltage waveform : 1.2 X 50 μs
  - Current waveform : 8.0 X 50 μs
  - Output impedance : 2 Ω, 12 Ω(Aux. Power)
    42 Ω(CT, DO, etc)
  - Relation to power supply : asynchronous
  - Polarity : positive, negative
  - Repeat : 5times each
  - Repetition rate : 60s
  - Test voltage : common 2.0kV, Differential 1.0kV

- Conducted disturbance test
  < Test Specification >
  - Frequency : 150 kHz ~ 80MHz
  - Dwell time : 1s
  - Step size : 1% of fundamental
  - Test voltage level : 10V

- Conducted emission & Radiated emission test
  < Test condition >
  - CISPR 22 Class A

- Vibration, shock and seismic test
  < Test condition >
  - Vibration response :
    Frequency range : 10 Hz ~ 150Hz
    Crossover frequency : 60Hz
    Test Parameter
    Below 60Hz : Peak displacement 0.035 mm
    Above 60Hz : Peak acceleration 0.5G(4.9 m/s2)
    Sweep cycle : 1(about 8 min)
    Direction : three different axes of the specimen in turn
  - Vibration endurance
    Frequency range : 10Hz ~ 150Hz
    Peak acceleration : 1G(9.8 m/s2)
    Sweep cycle : 20(about 160 min)

  - Shock response
    Peak acceleration : 5G(49 m/s2)
    Pulse duration : 11ms
    Direction : three difference axes of the specimen in turn
    Pulse number(each direction) : 3

  - Shock endurance
    Peak acceleration : 15G(147 m/s2)
    Pulse duration : 11ms
    Direction : three difference axes of the specimen in turn
    Pulse number(each direction) : 3

  - Bump
    Peak acceleration : 10G(98 m/s2)
    Pulse duration : 16ms
    Direction : three difference axes of the specimen in turn
    Pulse number(each direction) : 1,000

  - Seismic test
    Frequency range : 1Hz ~ 35Hz
    Crossover frequency : 8.5Hz
    Horizontal parameter :
    Below 8.5Hz : Peak displacement 3.5mm
    Above 8.5Hz : Peak acceleration 1G(9.8 m/s2)
    Vertical parameter :
    Below 8.5Hz : Peak displacement 1.5mm
    Above 8.5Hz : Peak acceleration 0.5G(4.9 m/s2)
    Sweep cycle : 1(about 10 min)
    Direction : three difference axes of the specimen in turn

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