SERVERON® TM1™

On-line DGA Monitor

Protect Transformer Assets

- Avoid transformer failures
- Enable condition based maintenance
- Extend transformer life
- Defer capital expenditures
- Breakthrough price/performance in on-line DGA

Product Summary

Description: Our industry leading on-line DGA monitors and TM VIEW™ software are monitoring generation, transmission and distribution power transformers worldwide. DGA (dissolved gas analysis) of transformer oil is the single best indicator of a transformer's overall condition. For the first time, the benefits of on-line condition monitoring can be realized across the distribution transformer fleet. The Model TM1™ continuously monitors hydrogen PPM Levels and can be programmed to alarm based on PPM Levels and/or Rate of Change (ROC), warning operators of potentially disruptive transformer faults and pending failures.

Application: Throughout your system there are transformers that are vital to the reliability of your grid – GSU's, large transmission transformers, and critical substation transformers. Serveron DGA transformer monitors provide the important and timely information needed to maintain the reliability and safety of transformer fleets.

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We solved the major reliability problems associated with single-gas monitors:

- **Eliminate Membranes:** The TM1 utilizes a patented, solid-state hydrogen sensor that is immersed directly in the oil, eliminating membranes and the potential for rupture.

- **Circulate Oil:** Without oil circulation inside the monitor, readings are unstable and show poor repeatability. The TM1 utilizes a patent-pending, maintenance-free, forced oil circulation system.

- **No Hydrogen Consumption:** For monitors that consume hydrogen during measurement, lack of oil circulation also means that hydrogen may be consumed faster than it can be replaced by diffusion, further reducing performance. In addition to circulating oil, the TM1 also utilizes a non-consumptive hydrogen sensor.

- **Hydrogen Selectivity:** Utilities monitor hydrogen because it is an excellent indicator of a wide range of transformer faults. Many “single” gas monitors are actually composite gas monitors whose hydrogen measurements are interfered with by contributions from carbon monoxide, acetylene and ethylene. These monitors measure only a very small percentage of acetylene and ethylene – in some cases less than 2%; not enough to indicate a fault. More problematic is the interference from carbon monoxide which exists at much higher levels than hydrogen. Carbon monoxide masks changes in hydrogen, potentially delaying recognition of a fault condition. The TM1 is selective for hydrogen exclusively.

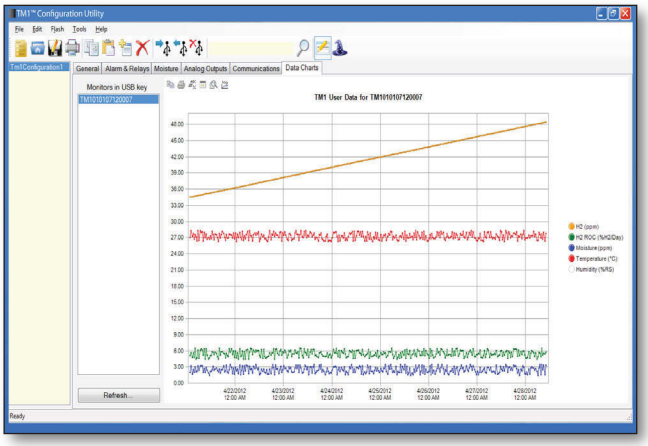
- **Temperature Control:** Hydrogen readings vary with temperature even when hydrogen concentration in the oil remains unchanged, resulting in fluctuating readings that potentially delay recognition of an event. The TM1 utilizes a patent-pending, thermally-controlled design that ensures stable results even under dynamic ambient or oil temperature conditions.

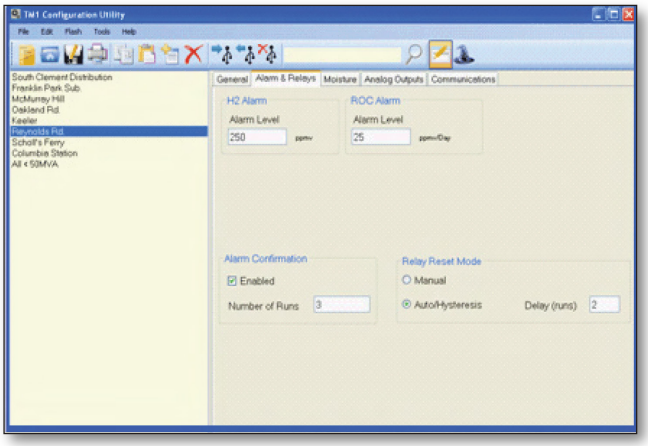
Gas-in-Oil and Rate-of-Change Trend Charts

- Hydrogen gas-in-oil is an early indicator of incipient transformer faults. Continuous monitoring of hydrogen levels warns operators of potentially disruptive transformer faults and pending failures.

Configuration Utility

- The TM1 comes with a simple, intuitive Windows-based configuration software tool that enables users to quickly configure alarm setpoints, scale analog outputs, and set other communication parameters.





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SERVERON® TM1™ on-line DGA monitor

Accuracy and Reliability

- The Model TM1 utilizes a highly selective solid-state hydrogen sensor immersed directly in the oil to deliver field-proven accuracy and reliability.
- Our patent-pending, thermally-controlled design with oil circulation ensures accurate and stable results even under dynamic ambient or oil temperature conditions.
- No requirement for a membrane, thereby improving monitor response time to changes in gassing levels as well as eliminating a component associated with poor reliability.
- Performs accurate DGA analysis on mineral and ester-based insulating fluids.

Low Total Cost of Ownership (TCO)

- Rapid and simple customer installation and configuration, reducing up-front costs.
- No scheduled maintenance due to no membrane, no sensor replacement, and no consumables or gases.
- A two year warranty as assurance for high reliability and low TCO.

Avoid transformer failures

- Continuous trending of hydrogen fault gas gives early and immediate warning of incipient faults that can lead to transformer failure.
- Many transformer failures can be prevented through the correlation of DGA data to real events.
- Hydrogen gas, oil temperature, and moisture in-oil are reported and correlated by the Model TM1.

Enable condition based maintenance

- On-line monitoring provides the information that enables continuous transformer condition assessment.
- Data from the Model TM1 provides rapid warning of developing faults through rapid response to changes in gassing levels and reporting of gas rate-of-change and gas limit alarms.

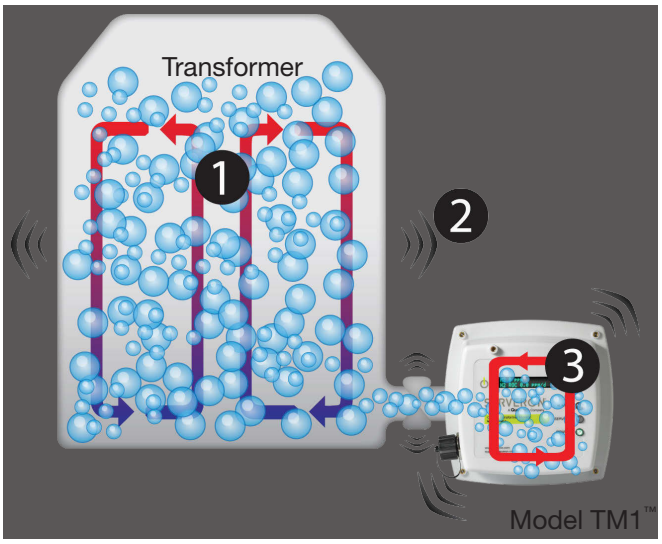
Extend transformer life and defer capital expenditures

- On-line monitoring of hydrogen gas and moisture enables intelligent management of transformers, extending their useful life and deferring capital expenditures.

Hydrogen Diffusion Mechanisms

The TM1 uses three diffusion mechanisms for ensuring a representative sample at the measurement point for accurate and reliable hydrogen monitoring.

1. Convective currents generated by the transformer windings
2. Vibration further aids oil movement and diffusion
3. Most importantly, forced oil circulation inside the monitor



TECHNICAL SPECIFICATIONS

DGA Method: Solid-state H_2 sensor immersed directly in the oil		Accuracy	Repeatability	Range[1]
	Hydrogen (H_2)	±15% or ±20 ppm	±5% or ±10 ppm	20 – 10,000 ppm
	1) Lower Detection Limit 20 ppm			
Additional Monitoring Options (Optional)		Accuracy		Range
	Moisture-in-Oil	±5%		0-100% RS
	Oil Temperature	±2°C (typically)		-40°C to +120°C
Gas Analysis Parameters	Oil Sampling Rate	Continuous oil sampling; gas analysis is reported every 30 minutes		
	Data Management	Data is date and time stamped; up to five years of data is stored in memory		
Display	Integrated display of H_2 Level, H_2 Rate of Change (ROC), Moisture (optional) and Service Codes.			
Alarms	Relay Contact Ratings	Max switched Power 100 W or 600 VA, Max switched Current 3 A, Max switched Voltage 150 VDC or 300 VAC		
	3 DGA Relays	Three (3) programmable alarm relays for H_2 Level (ppm), H_2 Rate of Change (ROC) (ppm/day), and optional Moisture		
	2 Alarm Relay	Two (2) alarm relays for power and service status		
External Inputs	Digital Inputs	RS232 for configuration utility and diagnostics; USB Mini B for direct connection with computer or USB Thumb Drive		
	Analog Inputs	Two (2) analog 4-20 mA inputs for optional moisture probe		

TECHNICAL SPECIFICATIONS

Communications	Standard Interfaces	RS232 / 485, USB 2.0, Three (3) analog 4-20 mA outputs for H_2 Level, H_2 Rate of Change (ROC) and optional Moisture
	Supported Protocols	DNP3 and Modbus
Environmental Specifications	Operating Temperature	-50°C to +55°C
	Oil Temperature	-20°C to +105°C
	Oil Inlet Pressure	0 to 100 psi (0 to 7 bar)
Physical Specifications	Product Dimensions	HxWxD: 9.2 in x 9.9 in x 12.3 in (23.4 cm x 25.1 cm x 31.2 cm)
	Product Weight	9 lb (4 kg)
	Enclosure Rating	NEMA 4X, IP66
Input Power Requirements	Voltage	100 - 240 VAC
	Frequency	50/60 Hz
	Current	0.8 A max.

Radiated and Conducted Emissions		Specification	Test Method
	Radiated Emissions	EN 61326-1: 2006	CISPR 11:2009 A1:2010 Class A
	Conducted Emissions	EN 61326-1: 2006	CISPR 11:2009 A1:2010 Class A
	Current Harmonics	EN 61000-3-2:2006 A1:2009 A	EN 61000-3-2:2006 A1:2009 Class A
	Voltage Fluctuations	EN 61000-3-3:2008	EN 61000-3-3:2008 Class A

Radiated and Conducted Immunity		Specification	Test Method
	ESD	EN 61326-1:2006	IEC61000-4-2:2009
	Radiated Immunity	EN 61326-1:2006	IEC61000-4-3:2006 A2:2010
	EFT	EN 61326-1:2006	IEC61000-4-4:2004 A1:2010
	Surge	EN 61326-1:2006	IEC61000-4-5:2006
	Conducted RF Immunity	EN 61326-1:2006	IEC61000-4-6:2009
	Magnetic Field Immunity	EN 61326-1:2006	IEC61000-4-8:2010
	Voltage Dips & Interrupts	EN 61326-1:2006	IEC61000-4-11:2004
	Vibration	IEC 60255-21-1	

Safety	Specification
	IEC 61010-1
	IEC 61010-2-81
	UL 61010-1 (2nd Edition)
	CSA-C22.2 No. 61010-1-04

On-line DGA Analysis Across Your Power Transformer Fleet

Leading utilities around the globe deploy the Serveron line of transformer monitors to provide superior asset protection for their transformer fleets across generation, transmission and distribution. With a low total cost of ownership, reliable field-proven performance and global customer service, Serveron transformer monitors set the standard for on-line DGA monitoring. Our transformer monitors can be deployed stand-alone or as part of the Qualitrol SmartSUB condition based monitoring system for transformers and other critical substation assets.

About Serveron®

Serveron transformer condition assessment and management tools are critical to utilities in improving grid reliability while optimizing the management and economics of their asset base. We are a leader in on-line DGA monitoring of power transformers with solutions across the entire power transformer fleet. Serveron is a QUALITROL Company.

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