SERVERON

Reliable energy through continuous, on-line DGA

- PROTECT AND MANAGE TRANSFORMER ASSETS
- AVOID UNPLANNED OUTAGES
- ENABLE CONDITION-BASED MAINTENANCE
- EXTEND TRANSFORMER LIFE

Reliable energy flow is paramount and your transformers are critical, and some of the costliest, assets in your grid. DGA (dissolved gas analysis) of transformer oil is the best indicator of a transformer's overall condition. Serveron's On-line Transformer Monitor Model TM8 provides the most comprehensive DGA condition assessment available. It provides the important and timely information you need to maintain the reliability of your transformer fleet.

ASSET MANAGEMENT IMPROVED—MEET YOUR RELIABILITY AND FINANCIAL GOALS:

Avoid unplanned failures: Continuous trending of all critical fault gases gives early and immediate notification of incipient faults that can lead to transformer failure.

Lower costs through condition-based maintenance: Only comprehensive on-line monitoring can provide the information that enables continuous transformer condition assessment.

Defer capital expenditures: Comprehensive analysis of all critical fault gases and other key parameters enable intelligent management of transformers, extending their useful life.

"Serveron's On-line Transformer Monitors help us maintain our transformer fleet reliability. As part of our ongoing maintenance programs, all new and critical power transformers will be equipped with the Serveron Transformer Monitors. By monitoring these critical assets we are able to lower maintenance costs and extend the life of the transformer while deferring capital expenditures."

—Jan Bennett, VP Customer Service,
Arizona Public Service Company

On-line Transformer Monitor Model TM8

The Serveron Transformer Monitor Model TM8

SERVERON MODEL TM8—FOR CRITICAL POWER TRANSFORMERS IN YOUR FLEET

Throughout your system there are transformers that are vital to the reliability of your grid—GSU's, large transmission transformers, and critical substation transformers.

The Model TM8 offers the most comprehensive DGA assessment available. This assessment is provided through accurate and repeatable on-line measurements of the 8 critical fault gases and other key parameters:

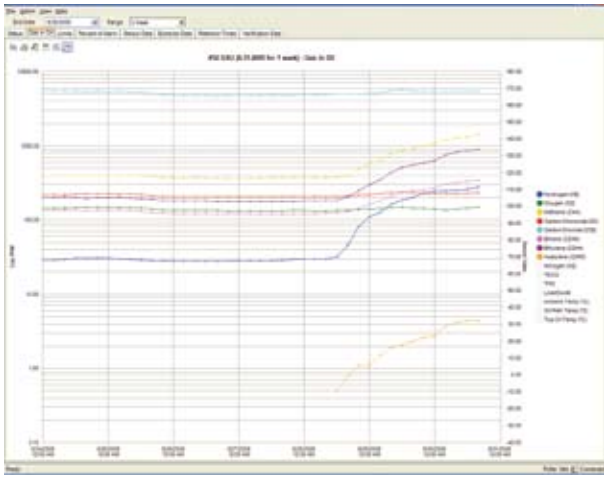
- Correlates all 8 fault gases, moisture-in-oil, oil temperature and ambient temperature to transformer load.
- The Model TM8 data supports all IEEE and IEC diagnostic tools for rapid warning and diagnosis of developing faults.

Comprehensive Data Requires Powerful Analytical Tools

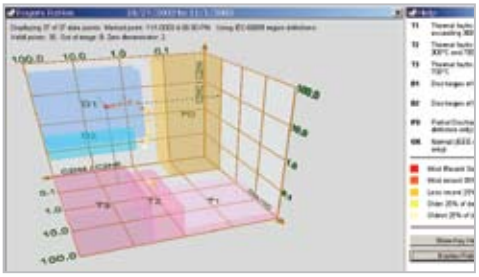
Serveron's software and services offer simple yet powerful tools for Transformer Monitor control, data presentation and analysis as well as management functions.

Serveron application software, included with each Transformer Monitor product, is used to locally or remotely control, retrieve, store, and view its data.

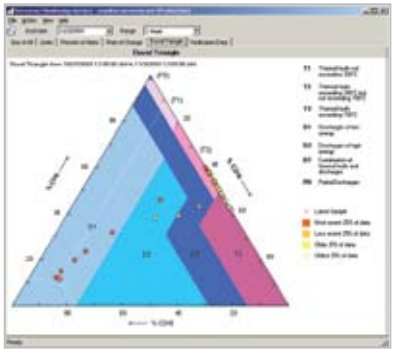
The recorded On-line data (DGA plus other parameters) is populated on diagnostic tools that deliver new and immediate insights for possible fault conditions.



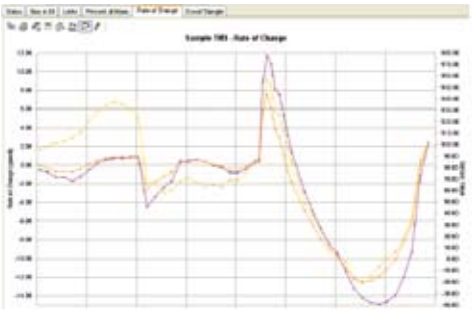
ROGERS RATIO AND BASIC GAS RATIOS



DUVAL TRIANGLE (IEC 60599-1999)



GAS LEVEL AND RATE-OF-CHANGE TRENDING



Serveron On-line Transformer Monitor Model TM8 Data Sheet

DGA METHOD: LABORATORY GRADE GAS CHROMATOGRAPHY

Gas		Accuracy[1]	Repeatability[2]	Range[3]
Hydrogen	H2	±5% or ±3 ppm	<2%	3-3,000 ppm
Oxygen	O2	±5% or +30/-0 ppm	<1%	30-25,000 ppm
Methane	CH4	±5% or ±5 ppm	<1%	5-7,000 ppm
Carbon Monoxide	CO	±5% or ±5 ppm	<2%	5-10,000 ppm
Carbon Dioxide	CO2	±5% or ±5 ppm	<1%	5-30,000 ppm
Ethylene	C2H4	±5% or ±3 ppm	<1%	3-5,000 ppm
Ethane	C2H6	±5% or ±5 ppm	<1%	5-5,000 ppm
Acetylene	C2H2	±5% or ±1 ppm	<2%	1-3,000 ppm
Nitrogen	N2	±10% or ± 5,000 ppm	<20%	5,000-100,000 ppm

Notes
All specifications are independent of oil temperature and gas pressure levels.

[1] Percent or PPM - whichever is greater
[2] At the calibration level
[3] Gas-in-Oil

MOISTURE-IN-OIL AND OIL TEMPERATURE OPTION

Parameter	Accuracy[4]	Range
Moisture-in-Oil	±2%	0-100% RS
	<10% of reading for oil temperature >30°C	0 to 80[5] ppm
	<18% of reading for oil temperature <30°C	0 to 80[5] ppm
Oil Temperature	±0.1°C (typ.)	-40°C to +180°C

[4] Includes non-linearity and repeatability
[5] Upper range limited to saturation

TOTAL DISSOLVED GASES

True Total Dissolved Combustible Gas (TDCG) output is available

(∑ H2, C2H2, C2H4, CO, CH4, C2H6 in PPM).
Each gas is measured at 100% of detected level.

Total Hydrocarbons (THC) output is available

(∑ CH4, C2H2, C2H4, C2H6 in PPM).
Each gas is measured at 100% of detected level.

GAS ANALYSIS

Oil sampling is continuous and gas analysis intervals are user-selectable from 2 hours to 12 hours (Default: 4 hours)

All data is date and time stamped.

Up to two years of data stored in memory.

Automatic schedule acceleration when rate of change alarm limit exceeded (Default: 1 hour)

System performs periodic auto-calibration to NIST[6] traceable gas standard.

[6] National Institute of Standards and Technology

ALARMS

Two (2) individually programmable Relays;

50V dc or 240 V ac @ 3A max. (125 V dc @ 1A max.)

(a) Gas Caution & Alarm for Level (ppm) and/or Rate-of-Change (ppm/day)

(b) Power, Service Event or Gas Caution and Alarm

Relay contacts operate as Normally Open or Normally Closed

EXTERNAL SENSOR INPUTS

Included Sensors;

- Transformer Load Guide
- Ambient Temperature

Three (3) analog 4 to 20mA inputs*

*Optional Moisture-in-Oil and Temperature Probe (uses 2 inputs)

COMMUNICATIONS

Serveron offers a variety of physical and protocol layer alternatives:

Standard Physical Layer Interfaces
RS-232, RS-485, Ethernet Fiber (100Base-FX), V.92 Internal POTS modem

Optional Interfaces
Cellular modem, Ethernet Copper (10/100Base-TX), Wireless Radio

Protocols supported include TCP/IP, DNP3, Modbus RTU, ASCII, OPC and IEC 61850 upon request

ENVIRONMENTAL SPECIFICATIONS

Operating Temperature	-50°C to +55°C
Cold Start Temperature	-20°C
Operating Humidity	5% to 95% RH, non-condensing
Oil Inlet Pressure	0 to 45 psi (0 to 3 bar)
Storage Temperature	-40°C to +75°C
Storage Humidity	5% to 95% RH, non-condensing

INPUT POWER REQUIREMENTS

Voltage	115VAC or 230VAC ±15%
Frequency	50/60 Hz
Current	6A maximum @ 115V 3A maximum @ 230V

PHYSICAL SPECIFICATIONS

Height	22.0 in (55.9 cm)
Width	20.0 in (50.8 cm)
Depth	11.2 in (28.4 cm)
Weight	65 lb (29.5 kg)
Enclosure Rating	NEMA 4X, IP66
Packaged Dimensions	26.4 in x 26.4 in x 15.9 in (67 cm x 67 cm x 40.3 cm)
Shipping Weight, Monitor pkg. only	70 lb (31.8 kg)

CERTIFICATIONS/STANDARDS

Radiated and Conducted Emissions

Specification	Test Method
EN 61326 Class A: 2002	EN 61326: 2002 Radiated Emissions EN 61326: 2002 Conducted Emissions
EN 61000-3-2: 2000	EN 61000-3-2: 2000 Current Harmonics
EN 61000-3-3: 2001	EN 61000-3-3: 2001 Voltage Fluctuations

Radiated and Conducted Immunity

Specification	Test Method
EN 61326 Annex A: 2002	IEC61000-4-2: 2001 ESD
	IEC61000-4-3: 2002 Radiated Immunity
	IEC61000-4-4: 2004 EFT
	IEC61000-4-5: 2001 Surge
	IEC61000-4-6: 2004 Conducted RF Immunity
	IEC61000-4-8: 2001 Magnetic Field Immunity
	IEC61000-4-11: 2004 Voltage Dips and Interrupts

Safety

IEC 61010-1, IEC 61010-2-81

UL 61010-1 (2nd Edition), UL 60950-1 Clause 6.4

CSA-C22.2 No. 61010-1-04

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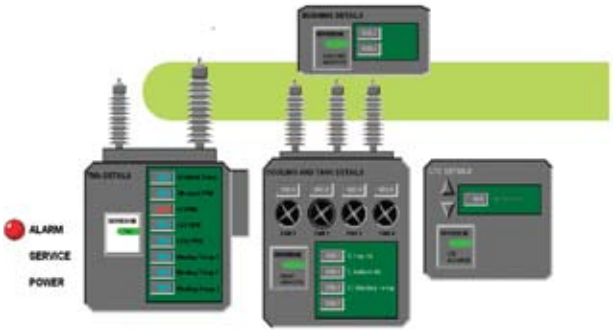
Serveron Products and Services

Asset Monitoring System

Serveron offers a complete asset management tool that integrates data from Serveron Temperature Monitors, Bushing Monitors, LTC devices, and state-of-the-art DGA Monitors. The Serveron Asset Monitoring System presents its multi-faceted perspective as a management dashboard to quickly reference any one of your most important substation assets, your transformers, with an immediate assessment in the context of historical performance.



Transformer Bushing Monitor

The TBM monitoring system permits live Power Factor testing with no downtime, and without the drawbacks associated with off-line Power Factor testing.

Transformer Advisory Service

Our transformer advisory service employs individuals with deep transformer management expertise to provide technical advice to support decisions based upon collected data enabling customers to Increase asset reliability by understanding the condition of equipment.

Serveron Monitoring Service

Our monitoring service provides the convenience of 24x7 access plus an analysis of the critical asset condition information provided by Serveron's products at your fingertips when it is most valuable.

Temperature Monitoring System

The TMS is a rugged, fully electronic, field-configurable temperature monitor and control system to help extend the life, utilize maximum capacity and reduce maintenance costs of liquid immersed power transformers.

Substation Automation System

Our Substation Automation (SA) provides an integrated communications environment; collecting data from various substation IEDs, processing the data and storing it in a secure open database. SCADA, local, as well as remote users may access real-time and historical data directly via the system's optional HMI.

SERVERON

bpl GLOBAL™
BETTER POWER LINES

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