

## Reliable energy through continuous, on-line DGA

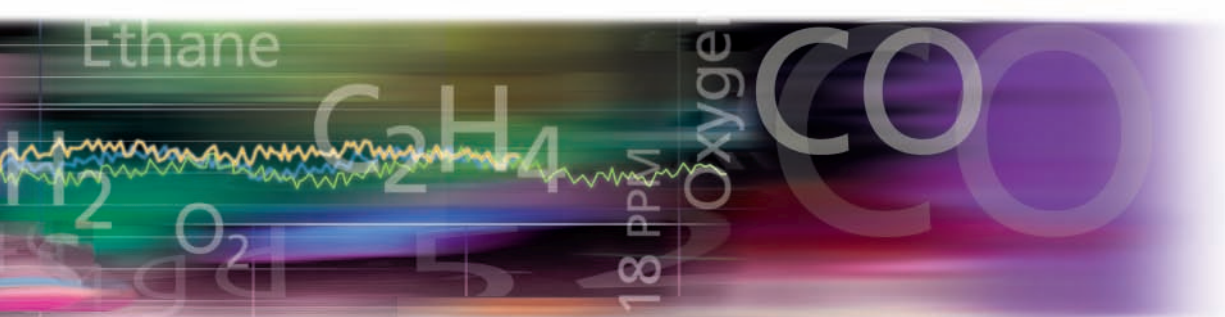


Reliable energy flow is paramount and your transformers are critical, and some of the costliest, assets in your grid. DGA (dissolved gas analysis) of transformer oil is the best indicator of a transformer's overall condition. Serveron's On-line Transformer Monitor Model TM8 provides the most comprehensive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

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



## The Serveron On-Line Transformer Monitor

**Many transformer failures can be prevented through the correlation of DGA data to real events. On-line monitoring of key gases is the most practical way to relate gassing levels to external events.**

Gas chromatography (GC) is the reference standard and accepted science for measuring gas-in-oil levels. The Serveron Transformer Monitor brings the DGA laboratory to your transformer with its rugged, closed-loop gas chromatograph system providing up to hourly sampling of eight critical fault gases. Correlation to real events is accomplished

through time stamping of all gas data as well as relative load and ambient temperature measurements. The Serveron Transformer Monitor also provides optional measurement capabilities

including oil temperature and moisture-in-oil readings. Field proven in utilities worldwide, the GC technology in the Serveron Transformer Monitor offers high reliability and low cost of ownership.



The Serveron Transformer Monitor offers accurate and repeatable measurements of eight critical fault gases and other key parameters.

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### 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.



# The Serveron Transformer Monitor Model TM8

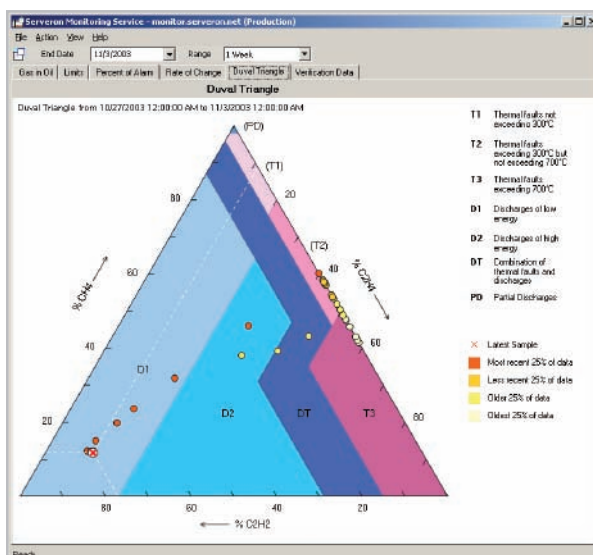
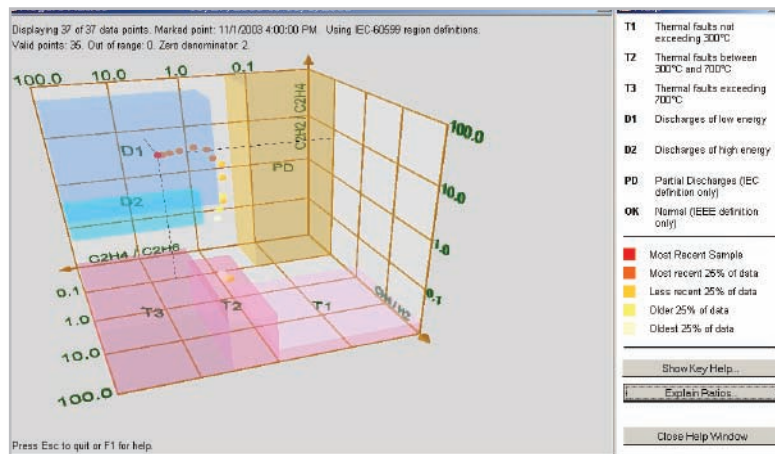
## SERVERON MODEL TM8—FOR CRITICAL POWER TRANSFORMERS IN YOUR FLEET

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:

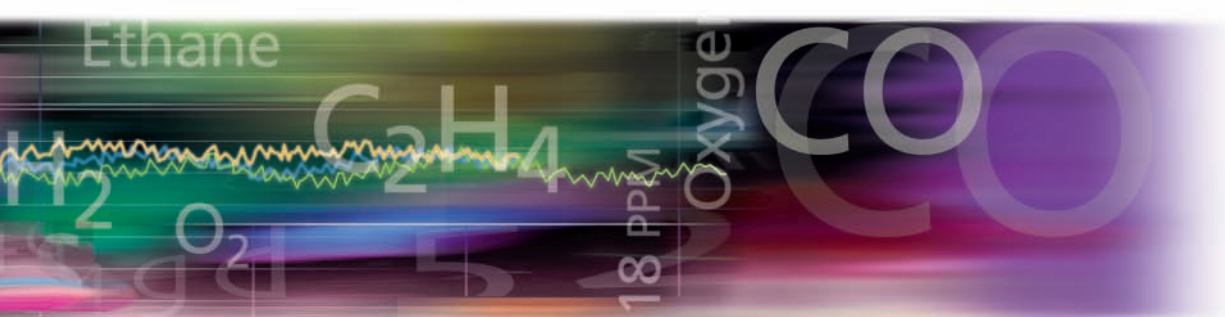
- Correlates all 8 fault gases, moisture-in-oil, oil temperature and ambient temperature to transformer load.
- The Model TM8 data supports all IEEE and IEC diagnostic tools for rapid warning and diagnosis of developing faults.

On-Line DGA data populating diagnostic tools delivers new insights. This displays Rogers Ratios (IEEE PC57.104 D11d) and basic gas ratios (IEC 60599-1999-03).



The Duval Triangle (IEC 60599-1999-03) provides a diagnostic outcome for combinations of three fault gases.

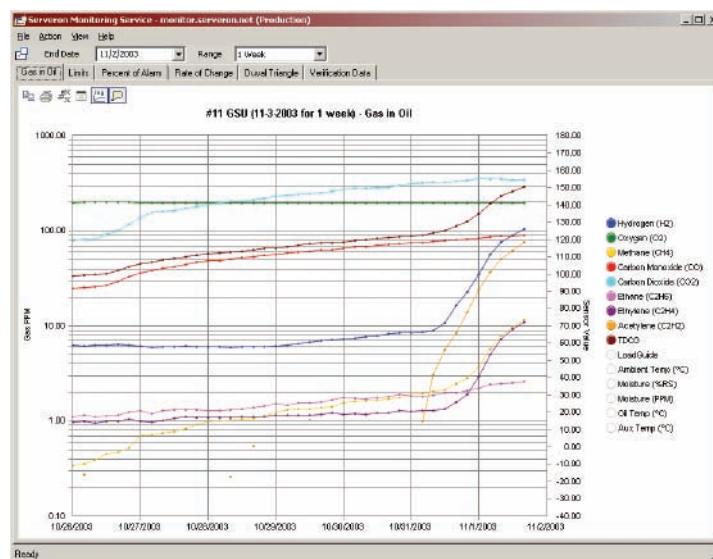
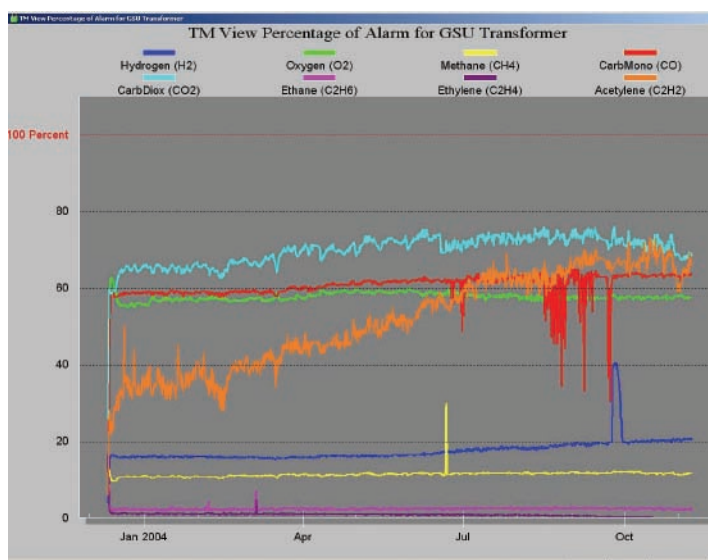




## Comprehensive Data Requires Powerful Analytical Tools

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

TM View is a software application that is included with every Serveron Transformer Monitor and is used to locally or remotely control the Transformer Monitor system or retrieve and review data.



The Serveron Monitoring Service offers the convenience of secure 24/7 access to all of your Transformer Monitor data from any Internet-connected Windows XP or Windows 2000 PC running our Serveron Monitoring Service software. This enables you to download your data from our secure website for trending, diagnosis and management of your data on-line or off-line.

## Information Where and When You Need It

**Serveron is committed to working in *your* network environment.** From transformer pad to your desktop, we offer an array of communication interfaces and protocols to seamlessly integrate into your existing systems. Whether you utilize our Serveron Monitoring Service or send the Transformer Monitor information to your SCADA, EMS or other system, we've got the connections.

# Serveron On-line Transformer Monitor Model TM8 Data Sheet

## DGA METHOD: LABORATORY GRADE GAS CHROMATOGRAPHY

Gas		Accuracy <sup>1</sup>	Repeatability <sup>2</sup>	Range <sup>3</sup>
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

### Notes

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

<sup>1</sup> Percent or PPM - whichever is greater

<sup>2</sup> At Gas Calibration Level

<sup>3</sup> Gas-in-Oil

## MOISTURE-IN-OIL AND OIL TEMPERATURE OPTION

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

<sup>4</sup> Includes non-linearity and repeatability

<sup>5</sup> Upper range limited to saturation

## TOTAL DISSOLVED GASES

True Total Dissolved Combustible Gas (TDCG) output is available

( $\Sigma$  H2, C2H2, C2H4, CO, CH4, C2H6 in PPM).

Each gas is measured at 100% of detected level.

Total Hydrocarbons (THC) output is available

( $\Sigma$  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<sup>6</sup> traceable gas standard.

<sup>6</sup> National Institute of Standards and Technology

## ALARMS

For each individual gas measured:

- Two individually programmable caution and alarm settings for Level (ppm) as well as Rate of Change (ppm/day)
- One gas alarm or service event (programmable) relay contact closure; One power status relay contact closure

## EXTERNAL SENSORS

Transformer LoadGuide®

Ambient temperature

Moisture-in-Oil and Oil Temperature transmitter (optional)

## COMMUNICATIONS OPTIONS

Serveron Transformer Monitors offer a variety of physical and protocol layer alternatives:

- Physical Layer interfaces include RS-232, RS-485, Ethernet (10/100Base-TX, 100Base-FX), cellular modem, V.92 Internal POTS modem, wireless radio
- Three 4-20ma inputs and one RS-232 port available to connect to optional devices
- Protocols supported include TCP/IP, DNP3, Modbus RTU and ASCII, OPC

## 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 4, 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



# Serveron Products and Services

## Transformer Monitors



The Serveron Transformer Monitors offer accurate and repeatable measurements of the critical fault gases and other key parameters.

Your transformers are critical and costly assets in your grid. Serveron's On-Line Transformer Monitors provide the most comprehensive condition assessment available.

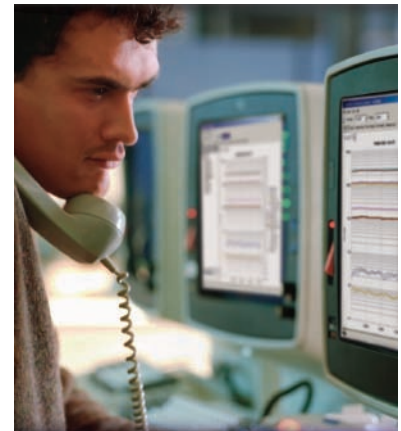
## Battery Cell Management Systems

Battery failures don't cause outages, but a failed battery system can make outages dramatically worse. Serveron's On-line Battery Cell Management (BCM) system ensures your batteries are fully available at all times while reducing maintenance expenses and extending battery life.



Serveron's BCM system is a unique solution that automatically optimizes battery life through its battery charge management function.

## Serveron Monitoring Service



The combination of Serveron's tools and monitoring service ensures that your personnel have immediate access to vital information about your assets.

The critical asset condition information provided by Serveron's products is most valuable when it is at your fingertips. The Serveron Monitoring Service provides the convenience of 24x7 access and analysis of your asset condition information.



**For more information, contact your nearest Serveron Representative or Serveron Corporation.**

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