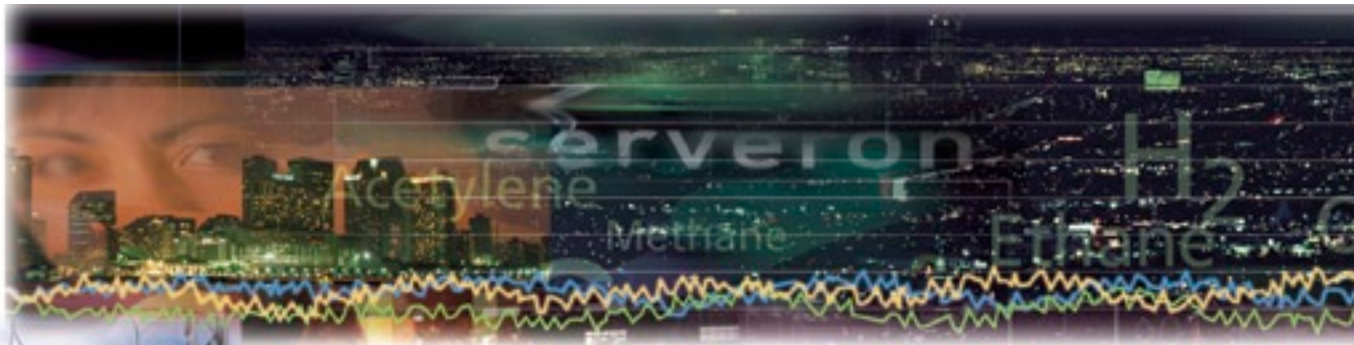


Reliable energy through cost effective, on-line DGA

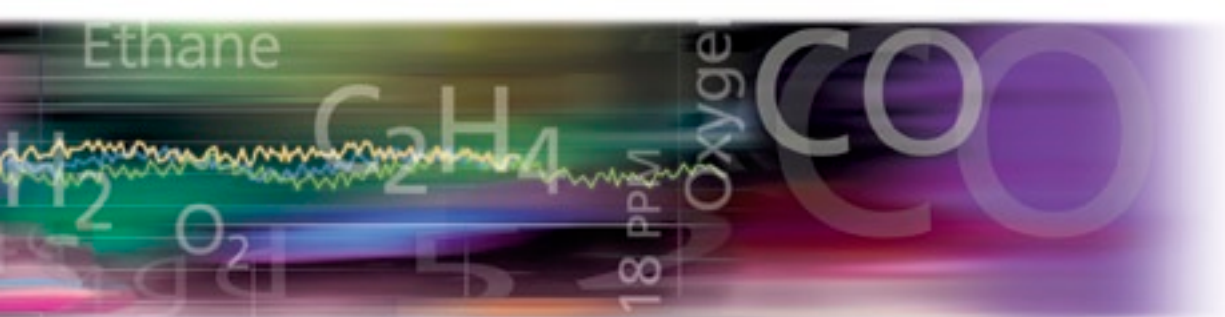


Reliable energy flow is paramount and your transformers are critical, and some of the costliest, assets in your grid. DGA (dissolved gas analysis) of transformer oil is the best indicator of a transformer's overall condition. Serveron's On-line Transformer Monitor Model TM3 is a transformer condition alert system that 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 three 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 three critical fault gases and other key parameters.

ASSET MANAGEMENT IMPROVED—MEET YOUR RELIABILITY AND FINANCIAL GOALS:

Avoid unplanned failures: Continuous trending of key 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 key fault gases and other key parameters enable intelligent management of transformers, extending their useful life.



The Serveron Transformer Monitor Model TM3

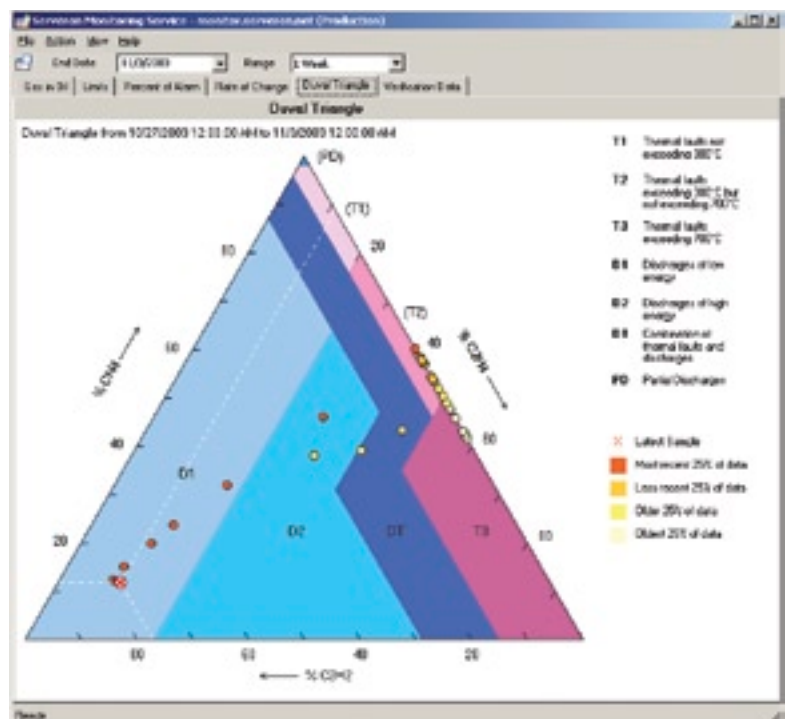
SERVERON MODEL TM3—FOR IMPORTANT TRANSFORMERS IN YOUR FLEET

You've got transformers that merit on-line monitoring, but the investment required couldn't be justified—until now. Serveron's Model TM3 is the only transformer condition alert system in its class that offers legitimate identification of the most critical transformer fault types. These critical fault types—partial discharge, arcing and thermal faults—can develop in a short period of time and lead to transformer failure.

The cost-effective Serveron solution consists of the analysis of three diagnostic gases in the Model TM3 monitor coupled with our Serveron Monitoring Service (SMS) Duval Triangle diagnostic tool. This combination provides diagnosis of critical incipient faults:

- Correlates 3 fault gases (acetylene, ethylene and methane), moisture-in-oil, oil temperature and ambient temperature to transformer load.
- The combination of on-line DGA data automatically populating the Duval Triangle provides unprecedented insight into fault diagnosis.

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

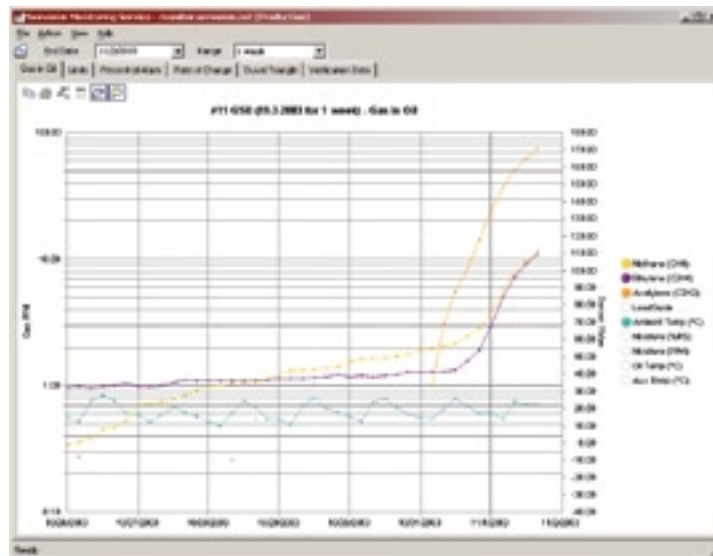




Comprehensive Data Requires Powerful Analytical Tools

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 TM3 Data Sheet

DGA METHOD: LABORATORY GRADE GAS CHROMATOGRAPHY

| Gas | Accuracy ¹ | Repeatability ² | Range ³ |
|-----------|---|----------------------------|--------------------|
| Methane | CH ₄ ±5% or ±10 ppm | <2% | 10-5,000 ppm |
| Ethylene | C ₂ H ₄ ±5% or ±3 ppm | <1% | 3-5,000 ppm |
| Acetylene | C ₂ H ₂ ±5% or ±1 ppm | <2% | 1-3,000 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 |

⁴Includes non-linearity and repeatability

⁵Upper range limited to saturation

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 NIST⁶ traceable gas standard.

⁶ 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; One power status relay contact
- Relay contacts operate as either Normally Open or Normally Closed

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:

- Standard physical layer interfaces include RS-232, RS-485, Ethernet (10/100Base-TX), V.92 Internal POTS modem
- Optional physical layer interfaces include cellular modem, Ethernet (100Base-FX), Wireless Radio
- Three 4-20ma inputs and one RS-232 port available to connect to external 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.

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.

