Introduction
In their average lifetime of 40 years, transformers endure various forms of stresses that can contribute to a multiplicity of failures (electrical, thermal, chemical or mechanical). Transformer failures may cause e.g. costly damages to primary and secondary equipment, outages, environmental cleanup charges and a loss of reputation.

DGA (Dissolved Gas Analysis) monitoring with SITRAM Multisense 9 helps utilities to avoid transformer failures.

SITRAM Multisense 9 indicates deviations and imminent faults by analyzing the concentration of eight dissolved gases in transformer insulating oil (mineral and ester oil), and moisture. This helps to predict and prevent eight fault types:

- High temperature thermal faults, overheated oil by monitoring \( \text{C}_2\text{H}_4 \)
- Partial discharge, thermal faults, power discharges, rust, galvanized parts, stainless steel, sunlight by Monitoring \( \text{H}_2 \)
- Corona partial discharge, low & medium temperature thermal faults by monitoring \( \text{CH}_4 \)
- Thermal fault involving cellulose, gradually from oil oxidation by monitoring \( \text{CO} \)
- Normal aging, thermal fault involving cellulose by monitoring \( \text{CO}_2 \)
- Hot spot, low energy discharge, high energy discharge (arc) by monitoring \( \text{C}_2\text{H}_2 \)
- Low & medium temperature thermal faults, local overheating by monitoring \( \text{C}_2\text{H}_6 \)
- Exposure to atmosphere (air), leaky gasket (under vacuum), air breathing conservator, leaky bladder by monitoring \( \text{O}_2 \)

Features
- Robust, NDIR measurement technology without moving parts or reference gas
- Easy installation directly at transformer - One man work
- Display and keypad enabling comprehensive configuration and setup without additional computer
- Easy to understand due to simple setup
- Compact, robust design (IP55)
- High accuracy enabling early diagnostics
- Optional: Various communication options, 13 digital outputs, 5 digital optocoupler outputs
- Optional: 10 analog outputs, 10 analog inputs
- Ambient humidity: 0-95%
- Monitoring functions:

Benefits
- Monitoring of all diagnostic gases inside the transformer oil, enabling recognition of all potential failure types
- Avoidance of major costs due to failures or outages
- Cost savings thanks to scheduled and efficient transformer maintenance
- Uses advanced software (the unit and via PC)
- Maintenance-free system

Scope of work
- Configuration and administration of each individual Multisense unit
- Data and configuration read-out of Multisense units
- Processing and visualization of data
- Read out (trend or table)
- Online functions (Status and process flow)
- Diagnostics functions (Duval triangle)
- Further processing of the data (Excel, CSV, clipboard and printing)
- Storage of the processed data and unit configuration

siemens.com/td-services
• Automatic data read-out and alerting by e-mail
• Standard electrical and mechanical connection kit, individual mechanical connection kit on request
• Installation flange (different ventilation sizes available)
• On-site training courses for operation and maintenance for our systems
• Optional: Turnkey installation and communications services.
• Optional: Expert analysis of monitoring data and customer support

### Technical Details

#### Operation Principle
- Miniaturized gas sample production based on headspace principle
- No membrane, negative pressure proofed
- Patent-pending oil sampling system (EP 1 950 560 A1)
- Near-infrared gas sensor unit for CO₂, CO, C₂H₂, C₃H₆, CH₄ and C₂H₄
- Micro-electronic gas sensor for H₂
- Thin-film capacitive moisture sensor H₂O
- Temperature sensors (for oil and gas temperature)
- Optional nominal voltages of auxiliary supply: 120 V AC 50/60 Hz or 230 V AC 50/60 Hz or 120 V DC or 230 V DC

#### Range and Accuracy

<table>
<thead>
<tr>
<th>Gas</th>
<th>Range</th>
<th>*Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>H₂</td>
<td>0 - 10000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>C₂H₂</td>
<td>0 - 10000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>CO</td>
<td>0 - 10000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>CO₂</td>
<td>0 - 20000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>CH₄</td>
<td>0 - 5000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>C₂H₄</td>
<td>0 - 10000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>C₂H₆</td>
<td>0 - 10000 ppm</td>
<td>± 5% or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>O₂</td>
<td>0 - 50000 ppm</td>
<td>± 10 % or ±LDL (whichever is greater)</td>
</tr>
<tr>
<td>H₂O</td>
<td>0 - 100%</td>
<td>± 3 % or ±LDL (whichever is greater)</td>
</tr>
</tbody>
</table>

* Accuracy quoted is the accuracy of the detectors during calibration

#### Fault gas measurement

SITRAM Multisense 9 is executed in two steps: gas extraction (headspace technique) and gas detection (non-dispersive infrared radiation method). It measures the concentration of dissolved gases in the oil.

Discover Siemens comprehensive transformer monitoring and sensor portfolio. For more information about Siemens comprehensive monitoring package for transformers, please contact your local partner or our Customer Support Center.

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