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SIEMENS

Ingenuity for life



SITRAM[®] H2Guard

Increased transformer
reliability through transparent
performance of oil

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Effective maintenance approach through online condition monitoring

Why oil gas monitoring?

Among the reasons for transformer outages, failures related to the winding have the highest rank. In cases of present partial discharge phenomena, which are also referred to as “sparking,” the transformer oil produces internal gases due to insulation capability loss.

One reason for the statistical outcomes in researched failure rates could be that the transformer oil is usually tested offline by classical analysis in oil laboratories. This procedure is not always trivial, and only an incomplete picture can be drawn because of the nature of non-continuous test approaches.

With the SITRAM® H2Guard, the new online dissolved gas analysis (DGA) system, Siemens offers a versatile single gas monitoring system for measuring hydrogen, and enables

asset managers to check the condition of transformer oil continuously with the advantages of trending and historical data.

The asset condition data allows a thorough evaluation and can reveal developing equipment issues before they become a problem. Maintenance work and repairs can be scheduled accordingly, maintenance downtimes and costs can be minimized, and adequate personnel support can be provided to foster best service results.

The solution: SITRAM® H2Guard

SITRAM® H2Guard can be used as a stand-alone system, or in combination with other monitoring platforms and can be easily integrated into existing SCADA landscapes through standard communication and protocol interfaces.



The SITRAM® H2Guard – Your advantages:

- Hydrogen measurement is based on a new solid state palladium alloy sensor technology achieving low maintenance & long life
- Periodic reference cycles are automatically run to eliminate offsets affecting long term stability
- No consumables, no reference gas needed, no membrane, no moving parts
- Oil temperature at sensing element is measured and is also available through the digital interfaces
- Field upgradable firmware and a variety of analogue and digital outputs also integrated into the communication Modbus protocol allowing expanding the hardware with further external components

Analyze the past, monitor the present, predict the future

Modern sensor technology

The actual sensing element is located in the probe tube, which should be fully inserted into the liquid phase of the insulating oil at the transformer tank or pipe system. It has a compact solid state design involving the chemical elements Palladium (Pd) combined with Nickel (Ni) in a thin film alloy that catalyzes the molecular hydrogen into atoms, which are then picked up by the Palladium and bound into the metallic lattice inside the film.

During this process of binding the hydrogen from oil, the bulk electrical properties of the alloy are changed and used for measurement.

Based on this measurement principle there is no need for consumables, like reference gases, which are used in gas chromatography. There is also no need for a classical membrane which is used in fuel cell sensor approaches based on the electrochemical principles or the thermal conductivity detection (TCD).

Flexible simplicity in configuration

The SITRAM® H2Guard system is capable of being simply configured by a short set of ASCII text commands without the need to install any special software, and is independent from an operating system or even device type since the device generally supports serial communication. The user can simply use the console or any terminal application natively offered by many operating systems or also available as (emulator) apps in the iOS App Store or Android Google Play Store.

While personal computers, smartphones or tablets do not normally have the RS-232 hardware serial interface there are wireless/air or wired adapters which are commonly used instead: e.g. USB to RS-232, or Bluetooth to RS-232, or W-LAN to RS-232. Either in this way or with the help of a Siemens proprietary solution the alarm setpoints and the analogue and digital interfaces can be set up among others. It is also possible to display or download logged data for further comprehensive and graphical analysis.

Efficient Asset Management: Assessing, addressing and acting

Accurate condition analysis

A transformer's oil loses its performance as insulation material if it becomes too wet. For this reason, and depending on the environmental conditions of the transformer, it makes sense to monitor moisture in the oil as well.

To realize this additional functionality with the SITRAM® H2Guard, an additional external moisture-in-oil sensor can be connected to an internal analogue interface. The combination of the variable's temperature, hydrogen and moisture elevates the validity and overall monitoring system accuracy.

Furthermore, the reliable determination of the actual oil condition related to hydrogen evaluation is achieved with a relatively new patented method (2013) including techniques for calculating gas concentrations in a fluid environment. It takes factors into account which can influence the gas sensor's measurements such as: temperature of the gas sensor, bias voltage applied to the gas sensor, overall

pressure of the fluid environment, and non-target gasses such as oxygen.

By considering these factors and introducing special feedback control algorithms, continuous self-calibration and the effective use of a sensor heater and additional components, the SITRAM® H2Guard is a valuable resource for asset managers.

Benefits in a nutshell

- Fast detection and reliable alarming
- Cost-effective and expandable system
- Very durable and minimum maintenance in comparison with other products on the market
- Easy to install / uninstall
- Interoperability and simple operation
- Competitive price with quick amortization considering classical assessment approaches.



Technical data

Measuring Demands*	
Range	25ppm – 5000ppm
Accuracy	20% of reading or 25ppm, whichever is greater
Repeatability	10% of reading or 15ppm, whichever is greater
Response Time	< 60min (90% of step change)
Cross-Sensitivity	< 2% to other gases CO, CO ₂ , CH ₄ , C ₂ H ₂ , C ₂ H ₄ , C ₂ H ₆ , C ₃ H ₈ , etc.

SITRAM® H2Guard - General Data	
Supply Voltage / Power Consumption	110 to 240 VAC, 50-60Hz
Ambient Operating Conditions	-40°C ... +70°C, indoor/outdoor also in harsh EMC areas, 5% ... 95% RH (non-condensing)
Operating Conditions	<ul style="list-style-type: none"> • Pressure and vacuum withstanding • Nominal oil temperature, pressure: ≤ 105°C / ≤ 3bar • Maximal oil temperature, pressure: 120°C / 5 bar
Physical Dimensions and Weight	Tube > ¾" NPT / 3.5", System > L: 406 W:127 H:140 mm (L:16.0 W:5.0 H:5.51 inch), 2.3kg
Ingress and Corrosion Protection	<ul style="list-style-type: none"> • IP67 (IEC 60529) • C5M (a.o. ISO 12944) • Weather and UV resistant powder coat (AAMA 2604) • Cast aluminium enclosure (UNS A03280) with a stainless steel probe tube (316 type)
Resistance to Shock and Vibration	<p>Among others tested on basis of:</p> <ul style="list-style-type: none"> • DIN EN 60068-2-6 – Shock and Vibration • DIN EN 60068-2-64 – Vibration Environmental Test • DIN EN 60068-2-27 – Shock Test for Transformer Environment <p>Additional performed tests such as extended, aggressive vibrational dwell at 50 and 60 Hz.</p>
Data Rate	Maximal 1 measurement value per second, Self-calibration: 2h every 12h
Output Relays	Four "Form C" relays with NO, NC, and COM terminals are available for use
Analogue I/O	<p>Supported functionality is dependent on firmware version*</p> <ul style="list-style-type: none"> • 2 inputs, standard: 4-20mA (e.g. for connection of an external moisture sensor) • 3 outputs, standard 4-20mA (first output is reserved to report hydrogen) <p><i>*Software configurable I/O (current- or voltage option)</i></p>
Communication	<ul style="list-style-type: none"> • Serial RS-232 and RS-485, Mini-USB, Ethernet • Protocols: Modbus over Ethernet or serial
Memory	<ul style="list-style-type: none"> • Existing Micro-SD slot (support is dependent on firmware version) • Also sufficient data storage capability on internal flash memory
Display and Status LED Indication	<ul style="list-style-type: none"> • Multi-line OLED monochrome graphics display (orange text on black background) • Three bright discrete LEDs (red, yellow, green)

*For a better understanding please refer to the details in the system manual.

Scope of supply and services

SITRAM® H2Guard designs

SITRAM® H2Guard monitors hydrogen gas and is capable of combining with other sensor technologies. The built-in analogue I/O interfaces allows for flexibility depending on individual customer requirements.

Each SITRAM® H2Guard comprises:

- Standard electrical and mechanical connection kit or individual mechanical connection kit on request
- Optional external sensors for measurement of moisture or temperature available on request.

Turnkey installation and communications services

- Expert analysis of monitoring data and customer support
- On-site training courses for operation and maintenance of our systems
- Design, installation and commissioning of all necessary equipment.



