



# MEASURING FAULT GASES. MINIMIZING RISKS.

Online oil analysis devices play an important role when it comes to analyzing the operational reliability of oil-filled, paper-insulated power transformers: They have a measurable impact on extending the service life of transformers.

The oil analysis devices of the MSENSE® DGA family from Maschinenfabrik Reinhausen provide ideal protection for transformers. They continually detect the gas concentration of the most important fault gases, hydrogen and carbon monoxide, as well as the moisture levels of the insulation medium. Depending on the device type, they also test a broad spectrum of gases, providing critical added security for transformers of particular strategic importance.

## Continuous oil testing is vital

According to experts in the field and international standards, hydrogen, carbon monoxide and moisture in the insulating oil of power transformers are the primary early indicators of potential thermal or electrical damage to the transformer (IEC 60475, IEC 60567, ASTM D 4057).

## Reliable condition diagnostics

The devices of the MSENSE® DGA family continuously monitor these early indicators – and much more.

This provides you with a reliable status diagnosis of your transformer at any time during operation. Much like a blood test in humans, the results of an online DGA of the transformer oil reveal developments inside the transformer. Faults trigger a warning or alarm at an early stage.

## Great reliability and optimal protection

Many international standards governing oil analysis of equipment describe the significance of oil quality in ensuring the seamless functioning of a transformer. In its "Guide for Transformer Maintenance" from 2011, CIGRE pointed out that five of six frequently occurring problems can be detected quickly and affordably using dissolved gas analysis (DGA) during transformer operation.

## Innovative measuring unit for extremely precise results

- A long service life and precise results in the ppm range for detecting hydrogen, carbon monoxide, and moisture directly in the oil flow
- The unit also measures the oil temperature
- Plant calibration in accordance with IEC 60567, Annex E for fresh mineral insulating oils and testing of each individual device
- The accuracy of oil analysis results can be enhanced using algorithm-based adjustment in the field – particularly for aged insulating oil

## Operation and long-term memory

- Available on request with an integrated display for reading out measured values, warnings and alarms and for parameterization directly on the device

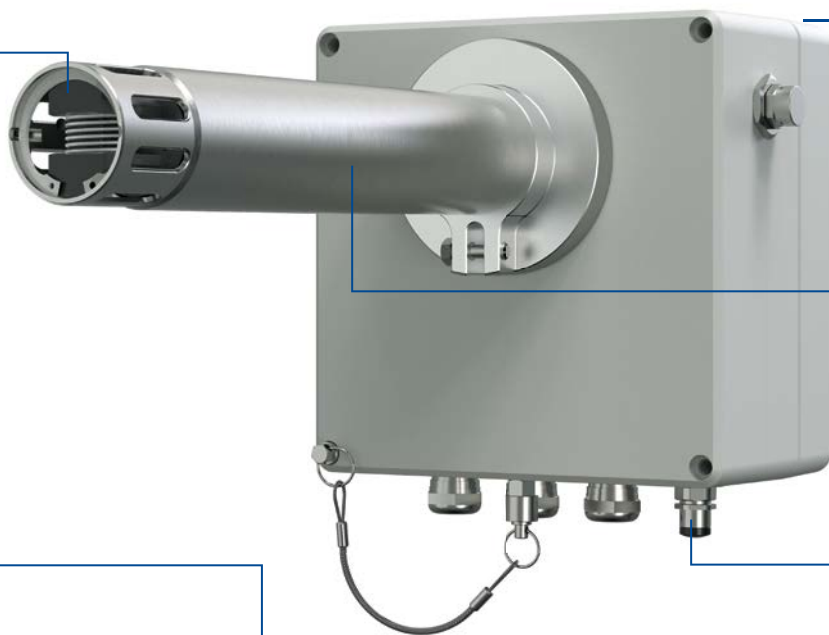
## Software

- Convenient operation of the measured value progression for trend analyses and parameterization using the included MSET software
- Storage of all measured values (hydrogen, carbon monoxide and moisture concentration) in the device for up to 3 years

## Clean and simple oil sample handling

- Standardized adapter for reliable oil sampling for lab analysis
- Attachable glass syringe prevents contamination, thus improving lab results
- Oil sample handling in accordance with IEC 60475, IEC 60567, ASTM D 4057

# IMPRESSIVE. MSENSE® DGA 2/3.



## Secure and reliable

- Effective protection against extreme environmental influences and mechanical loads (IP66, optional: offshore)
- Whether in the Arctic, the desert or the rain-forest: exceptional performance in any climate

## Durable stainless-steel pipe

- Two pipes of differing lengths make it possible to take measurements directly in the oil flow, depending on the transformer and attachment position
- Easy to retrofit onto existing systems

## Communication

- Interfaces to all common SCADA systems
- Data communication via Modbus RTU; optional: MESSKO® protocol converter for protocol communication via DNP3, Modbus TCP-IP, IEC 61850-8-1 MMS

## Integration into ETOS®

- Easy integration into the MR ETOS® Embedded Transformer Operating System

## Installation

- The included ball valve makes it possible to install the unit directly on the transformer, even during operation
- A variety of flange designs makes it easy to retrofit the unit to existing systems in real-world scenarios
- Vacuum resistant up to 5 Pa over 48 h in the manufacturing process and when filling power transformers with insulating liquids



# TREND AND FAULT CLASSIFICATION.

Both MSENSE® DGA 5 and MSENSE® DGA 9 offer continuous measurement results to ensure the reliability of strategic and important transformers.

MSENSE® DGA 5 and MSENSE® DGA 9 both provide continuous and reliable feedback on fault gases, placing the focus squarely on the condition of your transformer.

## Identify negative trends at an early stage

Monitoring and analyzing individual gases makes it possible to detect negative trends at an early stage and to take timely countermeasures in the event of potential risks.

For strategic and important transformers in particular, MSENSE® DGA sensors offer maximum protection during ongoing operation.

## No additional operating materials

Both online DGA analyzers scan the assigned gas matrix to detect and evaluate thermal and electrical faults. They do so using near-infrared (NIR) technology in combination with the patented headspace analysis (EP 1 950 560 A1). The use of calibration and carrier gases is unnecessary, which means you save on operating and maintenance costs.

## A product inspired by real-world use

The devices' lightweight and compact design allows them to be professionally installed and commissioned by a single technician. This is also possible without interrupting ongoing operation.

These features are supported by a focus on retrofitting power transformers using a simple attachment to just one valve connection, among other things. The technology mentioned here, in combination with our many years of experience, is also reflected in the resistance to vibrations and other interference factors during operation.

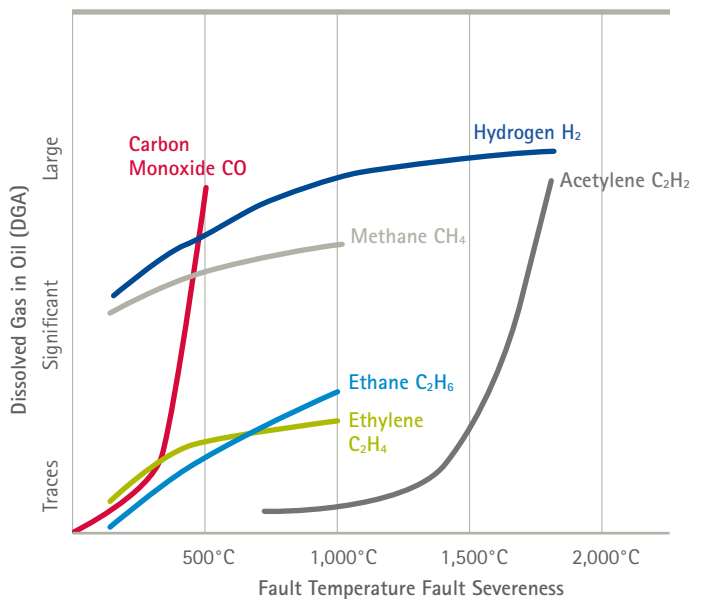
## MSENSE® DGA 5 – detailed fault analysis

A proven step in detailed fault analysis for critical and strategically important transformers: The use of MSENSE® DGA 5 guarantees comprehensive monitoring of fault gases.

### MSENSE® DGA 5 gas matrix

- Moisture in the oil
- Hydrogen  $H_2$
- Carbon monoxide  $CO$
- Acetylene  $C_2H_2$
- Ethylene  $C_2H_4$

IEEE C57.104-1991 3.1-3.3



# BEFORE IT GETS CRITICAL. MSENSE® DGA 5/9.



## MSENSE® DGA 9 – detailed fault analysis

The device with the 8-gas matrix recognized worldwide. For critical transformers or transformers with a high level of strategic importance, MSENSE® DGA 9 uses the algorithms based on the Rogers or Duval methods to provide detailed information about the classification of thermal and electrical faults.

## Communication

Interface to all common SCADA systems:

- RS 485 Modbus RTU (standard)
- Ethernet RJ45 or fiber-optic cable (standard, optional)
- DNP3 RS-485 modem (optional)
- IEC 61850 RJ45 modem (optional)
- IEC 61850 fiber-optic cable modem (optional)

## Graphic display

- Display of operating parameters
- Parameterization and configuration (17 operating keys)
- Display of measured values and trend development
- Rogers or Duval fault classification (only MSENSE® DGA 9)

## Mechanical connection

- Standardized mechanical connection compatible with all transformer models and types
- Connection with just one valve
- Practice-oriented retrofit capability







## MSENSE® DGA 9 gas matrix

- Moisture in the oil
- Hydrogen  $H_2$
- Carbon monoxide  $CO$
- Carbon dioxide  $CO_2$
- Methane  $CH_4$
- Acetylene  $C_2H_2$
- Ethylene  $C_2H_4$
- Ethane  $C_2H_6$
- Oxygen  $O_2$

# INTENSIVE MONITORING AND FAULT ANALYSIS.

A comparison of the devices of the MSENSE® DGA series.

Device name	MSENSE® DGA 2	MSENSE® DGA 3	MSENSE® DGA 5	MSENSE® DGA 9
Property:	Early warning system Alerts	Early warning system Alerts	Intensive monitoring Fault analysis	Intensive monitoring Fault analysis
				
Measuring component:				
Moisture in the oil	■	■	■	■
Hydrogen H <sub>2</sub>	■	■	■	■
Carbon monoxide CO		■	■	■
Carbon dioxide CO <sub>2</sub>				■
Methane CH <sub>4</sub>				■
Acetylene C <sub>2</sub> H <sub>2</sub>			■	■
Ethylene C <sub>2</sub> H <sub>4</sub>			■	■
Ethane C <sub>2</sub> H <sub>6</sub>				■
Oxygen O <sub>2</sub>				■
Application	Important transformers  Retrofit	Important transformers  Retrofit	Critical and strategically important transformers  Retrofit	Critical and strategically very important transformers  Retrofit
Interpretation and Fault detection	Measurement of absolute values  Trend analysis	Measurement of absolute values  Trend analysis	Measurement of absolute values  Trend analysis  Fault classification	Measurement of absolute values  Trend analysis  Fault classification  Rogers diagram  Duval triangle



**IEC 60599**

"Dissolved and free gas analysis (DGA) is one of the most widely used diagnostic tools for detecting and evaluating faults in electrical equipment filled with insulating liquid. (...) On-line gas monitors ... may be particularly well-suited for detecting non-typical rates of gas increase occurring within minutes, hours or weeks, which is generally not possible with routine oil samplings done at monthly or yearly intervals."

# ANALYSIS MADE EASY. THANKS TO INTUITIVE SOLUTIONS.

Online DGA monitoring, trend detection and evaluation.

## Intuitive MSET and MSET DGA software

If desired, you can use the user-friendly MSET and MSET DGA parameterization software to change settings from the factory pre-sets. For example, you can adjust individual limit values and the number of measurements taken per day. In addition, you can also parameterize the communication interface yourself. MSET displays the measured data in a simple and clear manner and provides a graphical or exportable display of trends.

Furthermore, based on the MSENSE® DGA 5 and MSENSE® DGA 9 device variants, MSET DGA offers the option of intensive monitoring and fault classification. Both solutions are included in the scope of delivery.

## ETOS®

ETOS® provides efficient control and monitoring of transformers thanks to the integration of monitoring and protective devices and conventional and intelligent sensors. With our MESSKO® and MSENSE® product brands, we offer field-proven components that ensure decades of error-free operation.

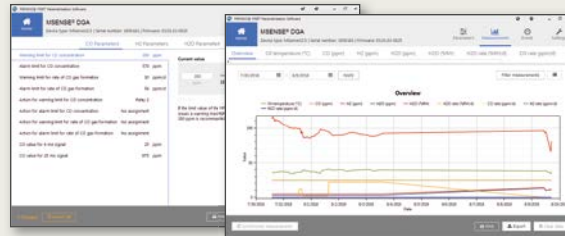
### For the use of the DGA function, this means:

- Easy integration through preconfiguration
- Recording and display of the gas matrix
- Trend detection
- Configurable limit values for each gas
- Measured-value memory
- Analysis and display based on Duval, Rogers, Doernenburg, and IEC 60599 (MSENSE® DGA 9 only)

MSENSE® DGA 2/3



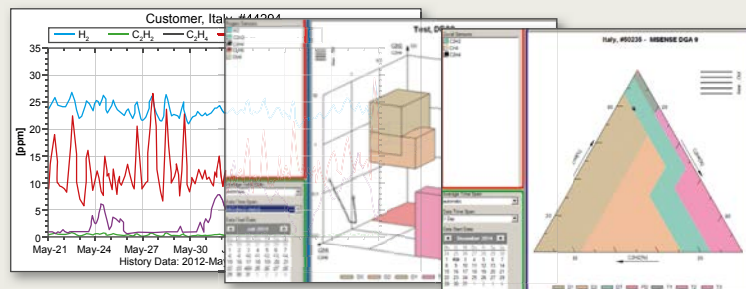
Software MSET



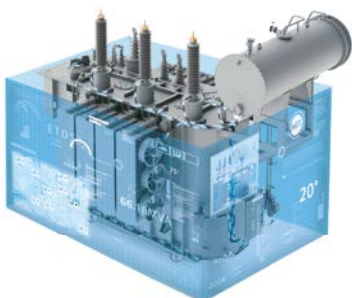
MSENSE® DGA 5/9



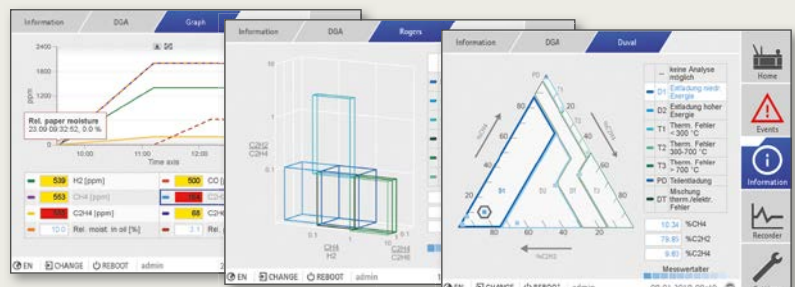
Software MSET DGA



ETOS® Embedded Transformer Operating System



ETOS Software



# MSENSE<sup>®</sup> DGA PRODUCTS. AN OVERVIEW OF THE HIGHLIGHTS.



## Optimal protection for your transformer

- For decades of reliable operation



## Cost efficiency

- No additional operating materials required
- Analysis without interrupting operation
- Optimization of your equipment maintenance cycles



## Simple operation and secure communication

- Optimized installation and commissioning
- Preconfigured integration in ETOS<sup>®</sup> and intuitive software
- Practical retrofit solution



## Durable and proven thousands of times over

- MR has many years of experience in the field
- We keep our word: for precision, quality and durability



## 24/7 global service network

- MR expertise available on demand in 150 countries
- 49 locations
- 7 training centers

**Maschinenfabrik Reinhausen GmbH**  
Falkensteinstrasse 8  
93059 Regensburg, Germany

Phone: +49 941 4090-0  
E-mail: [info@reinhausen.com](mailto:info@reinhausen.com)  
[www.reinhausen.com](http://www.reinhausen.com)

THE POWER BEHIND POWER.

