



DGA 1009



Multi-Gas-in-Oil Analysis System with
Transformer Monitoring Functions

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The DGA 1009 is a permanently installed multi-gas-in-oil analysis system with transformer monitoring functions. It individually measures, Moisture in Oil (H₂O) and the key gases Hydrogen (H₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄), Ethane (C₂H₆) and Oxygen (O₂) dissolved in transformer oil.

As Hydrogen (H₂) is involved in nearly every fault of the insulation system of power transformers and Carbon Monoxide (CO) is a sign of an involvement of the cellulosic / paper insulation the presence and increase of Acetylene (C₂H₂) and Ethylene (C₂H₄) further classifies the nature of a fault as overheating, partial discharge or high energy arcing. Oxygen (O₂) can be a sign of excessive ageing or leakages within the sealing of hermetic transformers.

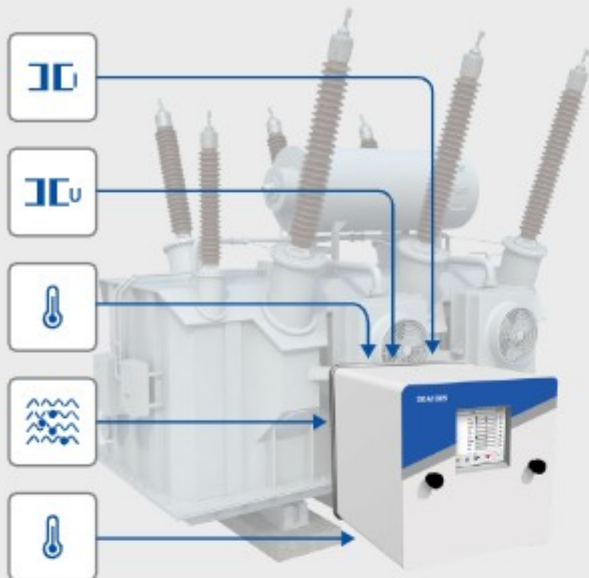
The device can serve as a compact transformer monitoring system by the integration / connection of other sensors present on a transformer via its optional analog inputs:

- 4 Analog inputs 0/4 ... 20mADC
- 6 Analog inputs 0/4 ... 20mAAC +20% or 0 ... 80 VAC +20% (configurable by jumpers)

Key Advantages

- Individual measurement of Hydrogen (H₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄), Ethane (C₂H₆) and Oxygen (O₂)
- Moisture in Oil (H₂O) measurement
- Easy to mount on a transformer valve (G 1½" DIN ISO 228-1 or 1½" NPT ANSI B 1.20.1)
- Installation on the operational transformer without any operational interruption
- Advanced software (on the unit and via PC)
- Maintenance free system
- Communication interfaces ETHERNET 10/100 Mbit/s (copperwired / RJ 45 or fibre-optical / SC Duplex) and RS 485 to support MODBUS[®]RTU/ASCII, MODBUS TCP, DNP3 proprietary communication and IEC 61850 protocols
- Optional 2G/3G modem with external adhesive antenna
- Optional DNP3 serial modem for SCADA connection
- Optional IEC 61850 modem for SCADA connection
- Optional HV and LV bushing sensors for HV and LV bushing monitoring applications via communication interface

Transformer monitoring functions



Voltages and Currents

(via voltage and current transformers / transducer)

Temperature Monitoring

Bottom and top oil temperature, ambient temperature
(via additional temperature sensors)

Cooling Stage / Tap Changer Position

(e.g. via current transducer)

Free configuration

Analog inputs can be free allocated to any additional sensor

Further Calculations:

- Hot-Spot (acc. IEC 60076)
- Loss-of-Life
- Ageing Rate

HV and LV Bushing monitoring functions (option)

The Bushing Monitoring System simultaneously monitors the bushing leakage current of 2, three phase groups of bushings. The Bushing Monitoring system incorporates three different measurement modes on each tested component to provide accurate Power Factor and Capacitance values to evaluate the condition of bushing insulation. The measurement modes are:

- **Phase comparison**
Compares the power factor of tested component with another tested component energized with the same phase voltage
- **Sum of three current test**
Measures the imbalance current from the summation of A, B and C phase currents from three tested components such as the three HV or LV bushings on the transformer
- **Adjacent phase reference test**
compares the power factor of the tested components with other phase components on the same equipment

The bushing sensors / adapters are connected to the capacitor taps designed for all types of bushings to allow measurement of the leakage current up to 140 mA. The adapters are designed for bushings with grounded and underground capacitor taps. The adapter is designed to prevent a voltage developing on the equipment should the sensor become disconnected from Bushing Monitoring System.

Different bushing sensor configurations possible:

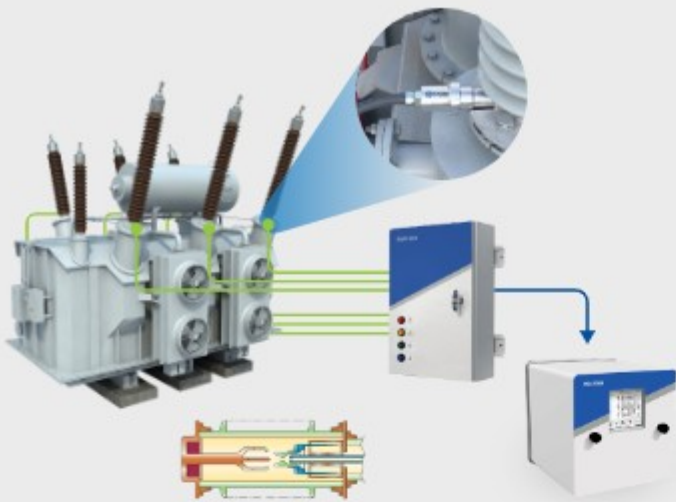
- Monitoring of high voltage side
- Reference HV bushing from other transformers
- Monitoring of high- and low voltage side
- Reference CCVT / CCPT

Configuration with 3, 6, 9¹⁾ or 12¹⁾ bushing sensors possible.

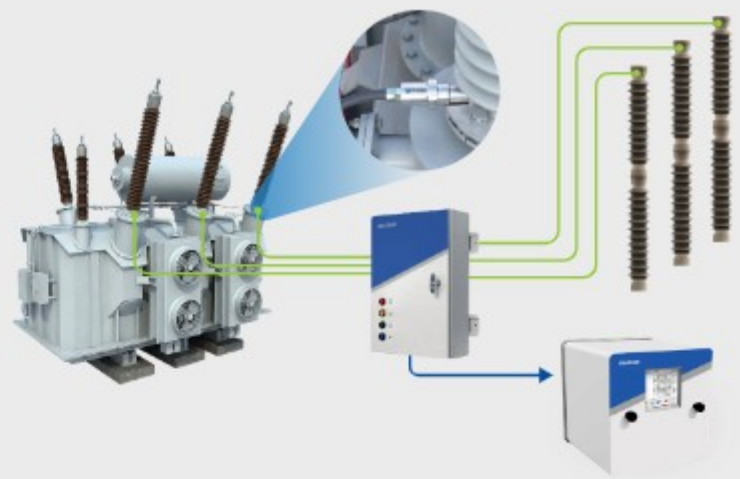
Notes

¹⁾ Two Bushing Monitoring units necessary

Monitoring of high- and low voltage side



Reference CCVT / CCPT



DGA firmware main menu

1 Extraction status

- Shows the actual operating status of the unit

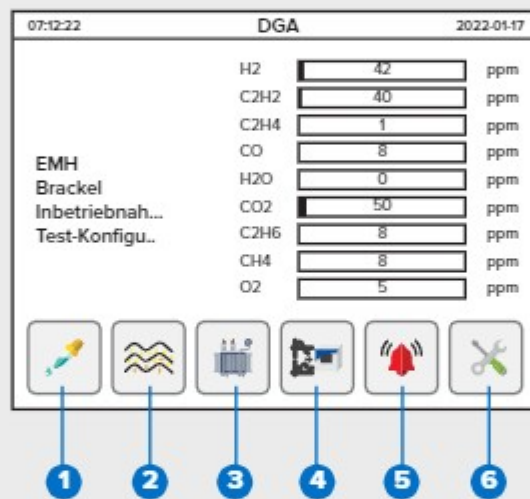
2 Gas-In-oil overview

- Column chart
- Trend graph
- Data table

3 Transformer specific measurements

- Trend graph
- Data table

(to be included)



4 Additional sensor measurements

- Trend graph
 - Data table
- (to be included)

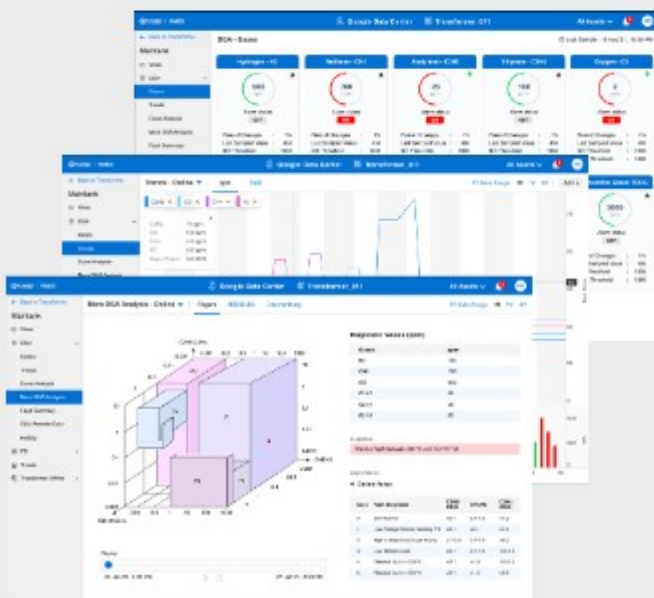
5 Alert overview

- Alert acknowledgement
- Alert table

6 Device setup

- Alert level setting
- Communication setting
- Transformer setting
- Input and output setting

DGA RM EYE-Software



Features

- Configuration and administration of each individual DGA unit
- Data and configuration read out of DGA units
- Processing and presentation of data read out (trend or table)
- Online functions (online sensors, extraction status and process flow)
- Diagnostic functions (Duval triangle and Rogers 3D graphic)
- Further processing of the processed data (Excel, CSV, clipboard and printing)
- Storage of the processed data and unit configuration
- Automatic data read out and alerting by e-mail

Technical Specifications

GENERAL INFORMATION	Optional nominal voltages of auxiliary supply	120 V -20% +15% AC 50/60 Hz 1) or 230 V -20% +15% AC 50/60 Hz 1) or 120 V -20% +15% DC 1) or 230 V -20% +15% DC 1) Other nominal voltages on request!	
	Power consumption	max. 600 VA	
	Housing	Aluminum	
	Dimensions	W 263 x H 274 x D 331 mm	
	Weight	approx. 15 kg	
	Operation temperature (ambient)	-55°C ... +55°C (below -10°C display function locked)	
	Oil temperature (in the transformer)	-20°C ... +90°C	
	Storage temperature (ambient)	20°C ... +65°C	
	Oil Pressure	0 - 800 kpa (negative pressure allowed)	
	Connection to valve	G 1½" DIN ISO 228-1 or 1½" NPT ANSI B 1.20.1	
SAFETY (CE CERTIFIED)	Insulation protection	IEC 61009-1:2002	
	Degree of protection	IP-55	
MEASUREMENTS	Gas/Moisture in oil Measurement		Accuracy ²⁾³⁾
	Measuring quantity	Range	
	Hydrogen H ₂	0 ... 10.000 ppm	± 15 % ± 25 ppm
	Carbon Monoxide CO	0 ... 10.000 ppm	± 20 % ± 25 ppm
	Carbon Dioxide CO ₂	0 ... 20.000 ppm	± 20 % ± 25 ppm
	Methane CH ₄	0 ... 5.000 ppm	± 20 % ± 25 ppm
	Acetylene C ₂ H ₂	0 ... 10.000 ppm	± 20 % ± 25 ppm
	Ethylene C ₂ H ₄	0 ... 10.000 ppm	± 20 % ± 25 ppm
	Ethane C ₂ H ₆	0 ... 10.000 ppm	± 20 % ± 25 ppm
	Oxygen O ₂	0 ... 50.000 ppm	± 10 % ± 1000 ppm
	Moisture H ₂ O (aw)	0 ... 100 %	± 3 %
	^{5)Option} ^{6)Moisture Saturation Content}	Moisture in Mineral Oil	0 ... 100 ppm
	Moisture in synt. Ester ⁵⁾	0 ... 2.000 ppm	± 3 % of MSC ⁶⁾
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 CO, C ₂ H ₂ and C ₂ H ₄		
	Near-infrared gas sensor unit for CO ₂ , CH ₄ and C ₂ H ₆		
	Micro-electronic gas sensor for H ₂ and O ₂		
	Thin-film capacitive moisture sensor H ₂ O		
	Temperature sensors (for oil and gas temperature)		
COMMUNICATION	RS 485 (proprietary or MODBUS® RTU/ASCII protocol)		
	ETHERNET 10/100 Mbit/s copper-wired / RJ 45 or fibre-optical / SC Duplex (proprietary or MODBUS® TCP protocol)		
	2G/3G modem with external adhesive antenna (optional) (proprietary protocol)		
	DNP3 serial modem (Option)		
	IEC 61850 modem (Option)		

ANALOG AND DIGITAL OUTPUTS	10 x Analog DC outputs		Default concentration (Free assignment)
	Type	Range	
	1 x Current DC	0/4 ... 20 mADC	Hydrogen H ₂
	1 x Current DC	0/4 ... 20 mADC	Carbon Monoxide CO
	1 x Current DC	0/4 ... 20 mADC	Carbon Dioxide CO ₂
	1 x Current DC	0/4 ... 20 mADC	Methane CH ₄
	1 x Current DC	0/4 ... 20 mADC	Acetylene C ₂ H ₂
	1 x Current DC	0/4 ... 20 mADC	Ethylene C ₂ H ₄
	1 x Current DC	0/4 ... 20 mADC	Ethane C ₂ H ₆
	1 x Current DC	0/4 ... 20 mADC	Oxygen O ₂
	1 x Current DC	0/4 ... 20 mADC	Moisture in Oil H ₂ O
	1 x Current DC	0/4 ... 20 mADC	Free programmable
10 x Digital outputs		Max. Switching capacity (Free assignment)	
Type	Control voltage		
10 x Relay	12 VDC		220 VDC/VAC / 2 A / 60 W

ANALOG INPUTS AND DIGITAL OUTPUTS (OPTION)	6 x Analog AC inputs		the measuring value	
	Type	Range	Accuracy	Remarks
	6 x Current AC or 6 x Voltage AC	0/4 ... 20 mA +20% or 0 ... 80 V +20%	≤ 1.0 %	Configurable by jumpers ⁴⁾
	4 x Analog DC inputs		the measuring value	
	Type	Range	Accuracy	Remarks
	4 x Current DC	0/4 ... 20 mADC	≤ 0.5 %	Configurable by jumpers ⁴⁾
	5 x Digital outputs		Max. Switching capacity (Free assignment)	
	Type	Control voltage		
	5 x Optocoupler	5 VDC	UCE: 24 V rated / 35 V max. UEC: 7 V max. ICE: 40 mA max.	

Notes

¹⁾120 V → 120 V -20% = 96 Vmin

230 V → 230 V -20% = 184 Vmin

²⁾Related to temperatures ambient +20°C and oil +55°C

³⁾Accuracy for moisture in oil for mineral oil types

⁴⁾Default Jumper configuration: Current

120 V +15% = 138 Vmax

230 V +15% = 264 Vmax

CONNECTIONS

- | | |
|---|---|
| 1 Supply Voltage | 6 RS 485 / Analog Modem |
| 2 System Connection | 7 Analog Outputs |
| 3 Connection thread | 8 Digital Outputs |
| 4 Ethernet Connector (only copper wired / RJ 45) | 9 Analog inputs and Digital Outputs (Option) |
| 5 2G/3G Antenna | |



Asset Monitoring : Enterprise Architecture

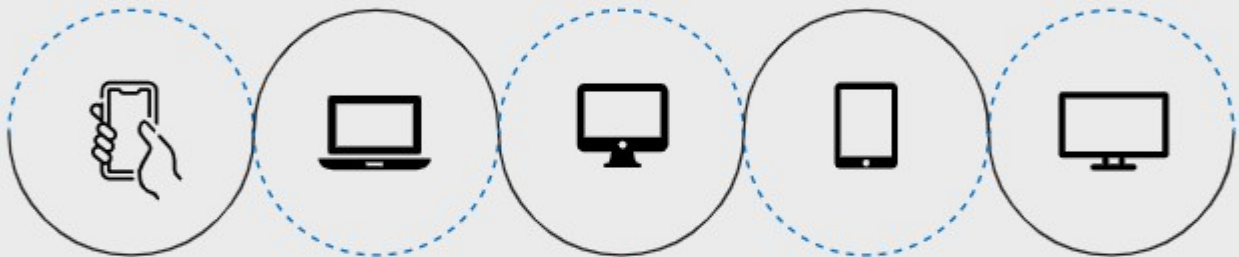
Compatible with Rugged Monitoring Enterprise Solution

UI UX



- Data Layer
- Analytics
- User Interface
- Custom Dashboards
- Reporting
- Email/SMS Notifications

RM EYE



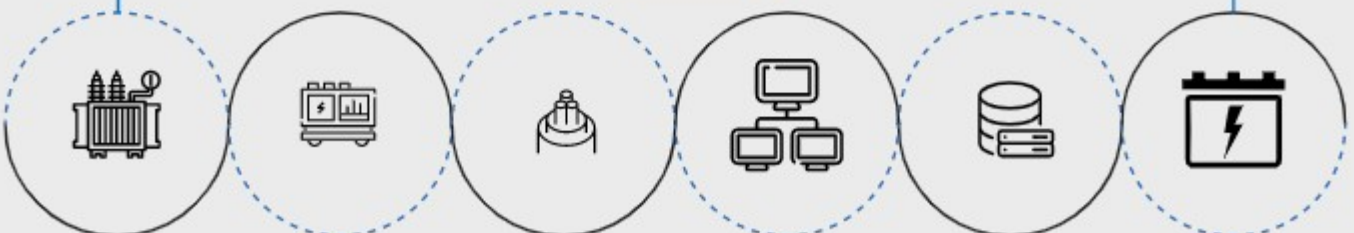
On-premise, Private Cloud, AWS, Azure, Google Cloud

IEC 60870-104
IEC 61850
FTP/SFTP
- XML, JSON
- CSV, COMTRADE


Data Collection

ODBC
MODBUS
DNP 3.0
HTTPS
MQTT

Asset Data



Transformer
Monitoring
System

Switchgear
Monitoring
System

Power Cable
Monitoring
System

- Offline Test Results
- Inspection Records
- Name Plate

- Historian
- CMMS
- SCADA/ DCS

Power Electronics
(Battery, UPS,
VFD, Relay)

Why Customers Choose Us?

RM solution, the trusted monitoring solution for over 10000+ assets across 50+ countries. We are a leading High Value Electrical Asset Monitoring Company integrating fibre optic technology to the assets.



Attention to Details

It's our attention to the small stuff, scheduling of timelines and keen project management that makes us stand out from the rest.



A plan for Success

Our Customers are well satisfied with the advisory services that we offer to help them with best in class technological performance and a long durable life.



Experts only

We bring in our diversified experienced team with over 100+ years of experience in Asset Monitoring



Meeting Deadlines

Work with us, and you'll work with seasoned professionals – vigilant of deadlines, and committed to exceeding client expectations.



Money Matters

We protect you against currency fluctuation with competitive and fair market prices



Rugged Monitoring Services

Rugged Monitoring provides customization of sensors, monitors & software. In addition we offer on-site commissioning services, maintenance contracts and technical support to all customers worldwide.

About Rugged Monitoring

Industry's leading team of asset condition monitoring experts with 100+ years of combined experience committed to delivering customizable solutions for challenging applications. We offer a range of reliable, high performance, customizable sensors and monitoring solutions that are immune to external influence.

Certification



ISO 9000



ISO 14000



ISO 45001/
OHSAS 18000



Lloyd's
Register



ATEX
Certification

Our footprints Across the Globe



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