MTE Meter Test Equipment

HYDROCAL 1009-3

Multi-Gas-in-Oil Analysis System for monitoring a bank of three single phase transformers located next to each other



The HYDROCAL 1009-3 is designed for multi-gas-in-oil analysis on a bank of three single phase transformers located next to each other. This new wall mounted system allows for the individual measurement of Moisture in Oil (H_2O) and the key gases 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) and Oxygen (O_2)dissolved in transformer oil utilizing a sampling system that samples oil from each tank via three separate oil channels expertly engineered to provide negligible mixing of oil.

As Hydrogen (H_2) 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 (C_2H_2) and Ethylene (C_2H_4) further classifies the nature of a fault as overheating, partial discharge or high energy arcing.

It is further equipped with digital outputs for the transmission of alarms or the execution of control functions (e. g. control of a cooling system of a transformer):

- 10 digital relay outputs (optional)
- 5 digital opto-coupler outputs (optional)
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Key Advantages

- 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) and Oxygen (O_2)
- Moisture-in-oil (H_2O) measurement
- Monitor three tanks with one HYDROCAL 1009-3
- Communication interfaces ETHERNET 10/100 Mbit/s (copper-wired / RJ 45 or fibre-optical / SC Duplex) and RS 485 to support MODBUS®RTU/ASCII, MODBUS®TCP
- Optional 2G/3G modem with external adhesive antenna
- Optional IEC 61850 modem for SCADA connection

Technical data HYDROCAL 1009-3

General

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 +15% DC [1] or 230 V -20% +15% DC [1] Other nominal voltages on request!
Power consumption:	max. 900 VA
Housing:	Mild Steel
Dimensions:	W 600 x H 800 x D 400 mm
Weight:	approx. 80 kg
Operation temperature: (ambient)	-55°C ... +55°C (below -10°C display function locked)
Oil temperature: (in the transformer)	-20°C ... +105C
Storage temperature: (ambient)	-20°C ... +65°C
Connection to valve:	All Valves possible / pipe with diameter of 6mm connectable without adapters 2 valves necessary (in/out) / max. distance 30m

Safety

	CE certified
Insulation protection:	IEC 61010-1:2011-07
Degree of protection:	IP-65

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_2H_2	0 ... 10.000 ppm	± 20 %± 5 ppm
Ethylene C_2H_4	0 ... 10.000 ppm	± 20 %± 10 ppm
Ethane C_2H_6	0 ... 10.000 ppm	± 20 %± 15 ppm
Oxygen O_2	0 ... 50.000 ppm	± 10 %± 1000 ppm
Moisture H_2O (a_w)	0 ... 100 %	± 3 %
Moisture in Mineral Oil	0 ... 100 ppm	± 3 %± 3 ppm
Moisture in synt. Esther[5]	0 ... 2.000 ppm	± 3 % of MSC[6]

[5]optional [6]Moisture Saturation Content

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_2H_2 and C_2H_4
- Near-infrared gas sensor unit for CO_2, CH_4 and C_2H_6
- Micro-electronic gas sensor for H_2 and O_2
- Thin-film capacitive moisture sensor H_2O
- Temperature sensors (for oil and gas temperature)

Analog and digital outputs (optional)

12/24/36 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_2H_2
1 x Current DC	0/4 ... 20 mADC	Ethylene C_2H_4
1 x Current DC	0/4 ... 20 mADC	Ethane C_2H_6
1 x Current DC	0/4 ... 20 mADC	Oxygen O_2
1 x Current DC	0/4 ... 20 mADC	Moisture in Oil H_2O
1 x Current DC	0/4 ... 20 mADC	Free programmable

12/24/36 x Digital outputs		Max. Switching capacity (Free assignment)
Type	Control voltage	
12/24/36 x Relay	12 VDC	220 VDC/VAC / 2 A / 60 W

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
- IEC 61850 modem (Option)

Notes

[1] **120 V** ⇨ 120 V = **120 V_{min}** 120 V +15% = **138 V_{max}**
230 V ⇨ 230 V -20% = **184 V_{min}** 230 V +15% = **264 V_{max}**

[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