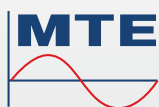


Manufactured by:



Hydrocal 1008

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



HYDROCAL 1008 is a permanently-installed multi-gas-in-oil analysis system with transformer monitoring functions. It allows for the individual measurement of moisture 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) and ethane (C_2H_6) dissolved in transformer oil.

As hydrogen (H_2) is involved in nearly every fault of the isolation system of power transformers and carbon monoxide (CO) is a sign of an involvement of the cellulosic/ paper isolation 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. The device can serve as a compact transformer monitoring system by the integration / connection of other sensors present on a transformer via its analog inputs:

- 4 analog inputs 0/4-20mADC
- 6 analog inputs 0/4-20mADC / 0-100VAC configurable by jumpers

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)

- 8 digital relay outputs
- 5 digital opto-coupler outputs

Key Advantages

- Hydrogen (H_2), carbon monoxide (CO), carbon dioxide (CO_2), methane (CH_4), acetylene (C_2H_2), ethylene (C_2H_4) and ethane (C_2H_6), measurement.
- Moisture-in-oil measurement
- Communication interfaces ETHERNET 10/100 Mbit/s (both copper-wired/fibre-optical) and RS 485 to support proprietary communication protocols and to be open/ prepared for substation communication protocols IEC 61850, MODBUS, DNP 3 etc.
- Optional on-board GSM and analog modems for remote communication
- 6 analog AC voltage inputs for the connection of capacitive HV bushing sensors for HV bushing monitoring application.

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Transformer monitoring functions

Voltagess and Currents

(via voltage and current transformers / transducer)

Temperature Monitoring

Bottom and oil temperature (via additional temperatures sensors)

Free configuration

Analogue inputs can be free allocated to any additional sensor

Further Calculations:

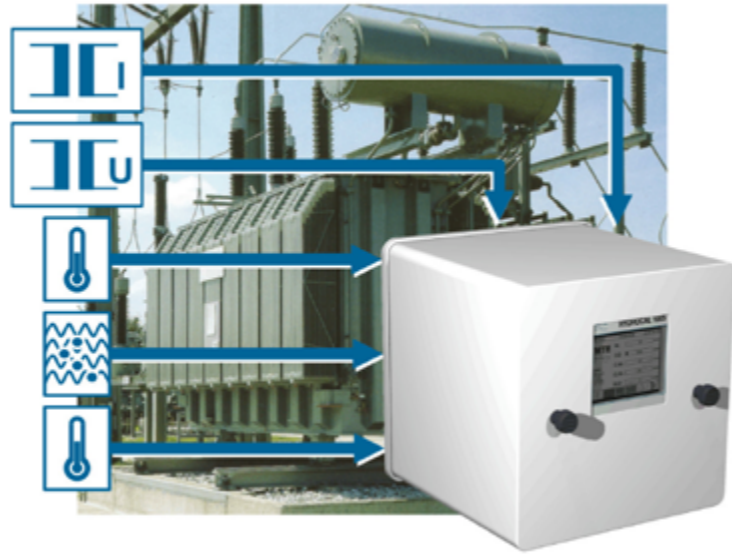
Hot-Spot (acc. IEO 60076)

Loss-of-Life

Ageing Rate

Cooling Stage / Tap Changer Position

(e.g. via current transducer)

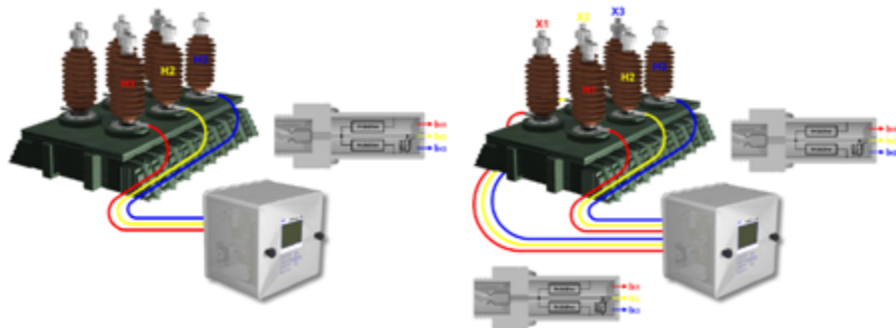
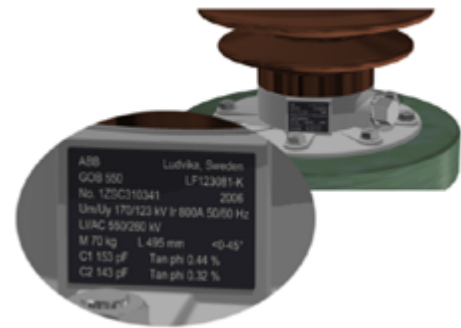


joint R&D design together with power transformer manufacturer PAUWELS

HV Bushing Monitoring

HV Bushing / Test tap / Name plate

Test methods: Leakage current
Sum of currents



Capacity C1 and tand / PF under factory testing are documented on name plate of bushing

Configuration 1:
Monitoring of high voltage side

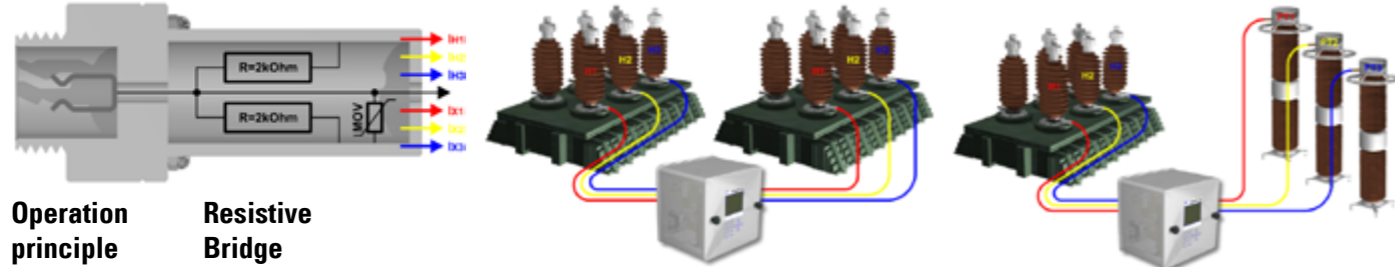
Configuration 2:
Monitoring of high voltage and low voltage side

Bushing sensor

(joint development with ZTZ Services International, USA)



Test method: $\tan \delta$ (dissipation factor)
PF (power factor)



Operation principle

Voltage range 69 kV – 765 kV AC (Bushing / Primary)
Max. 2.5 kV AC (Sensor / Secondary)
Current range 0 – 140 mA AC
Thread 0.75" / 1.25" / 2.25"
(other configurations available upon request)

Resistive Bridge

Configuration 1:
Reference HV bushing (from other transformer)

Configuration 2:
Reference CCVT/CCPT

Sensor firmware main menu

User menu

- Transformer administrator data
- Customer / Site administrator data

External menu

- Voltage and current measurement
- Bottom and top oil measurement
- Oil humidity measurement

Gas-in-Oil menu

- Chart diagram
- Result table

Alarm menu

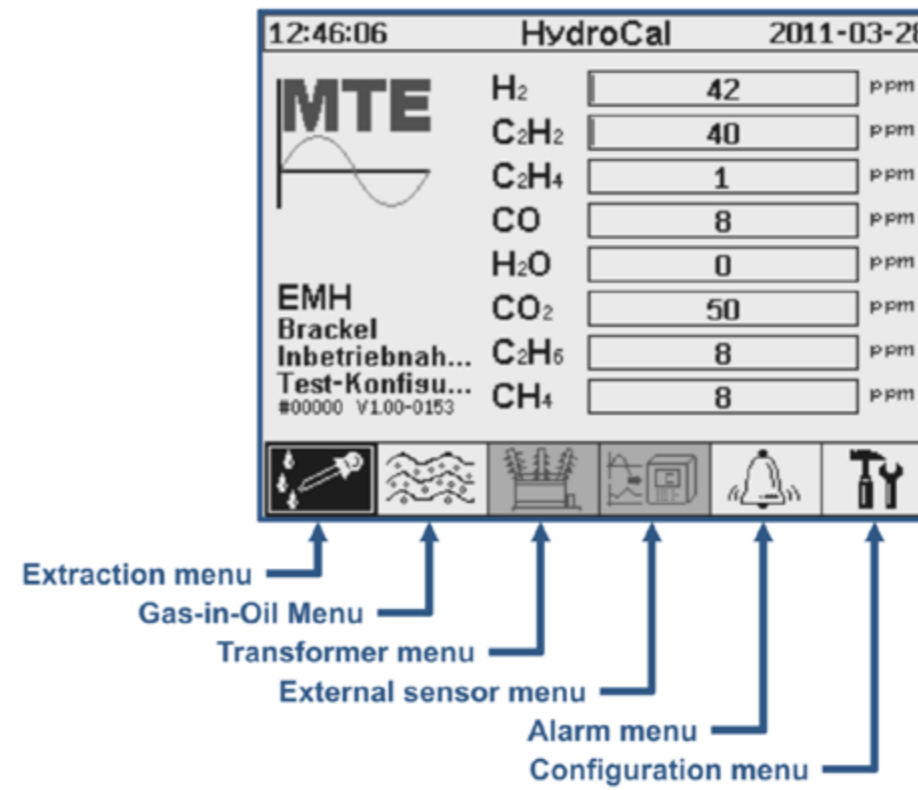
- Report table
- Alarm acknowledgement

Transformer menu

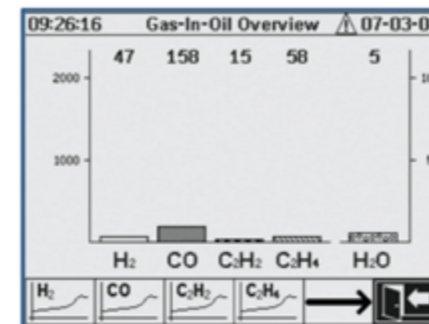
- Aging rate
- Hot spot temperature
- Loss-of-Life

Configuration menu

- Alarm level setting
- Communication setting
- Transformer setting Installation

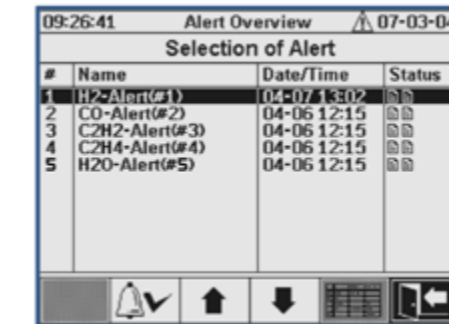


Gas-in-Oil menu



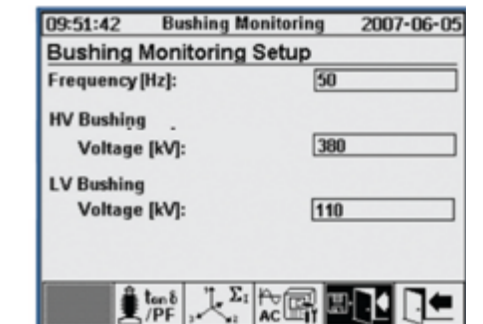
Individual chart diagram for hydrogen (H₂), carbon monoxide (CO), carbon dioxide (CO₂), methane (CH₄), acetylene (C₂H₂), ethylene (C₂H₄) and ethane (C₂H₆) and moisture.

Alarm setup / edit menu



Display of alarm list. Details of each alarm and individual settings.

Bushing monitoring setup menu

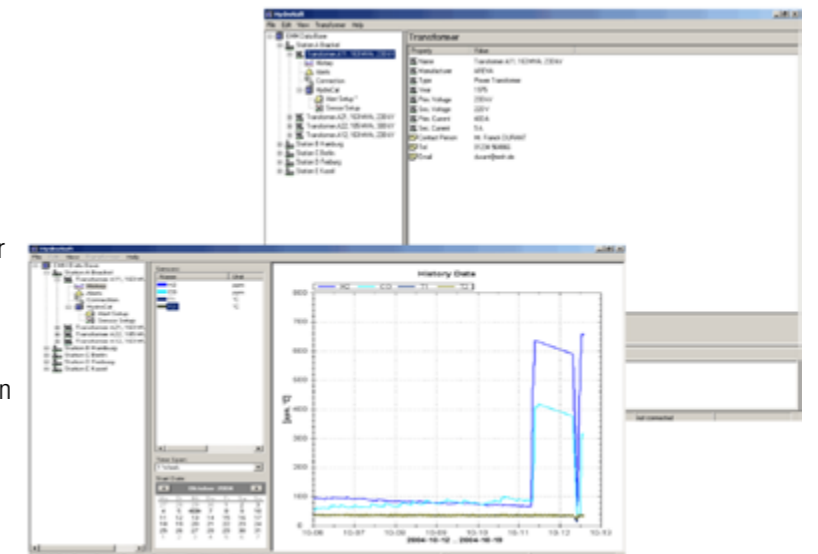


The bushing monitoring setup menu allows the input of all basic parameters required for the bushing monitoring.

PC-Software

Transformer administration data

- All administration data of a transformer can be entered
- Network of different power plants and transformer banks can be configured
- Selective contact to each transformer in the network
- Obtaining information of total transformer situation



Technical Data HYDROCAL 1008

General

Auxiliary supply	88 VACmin ... 276 VACmax Optional: 88 VDCmin ... 350 VDCmax
Power consumption	max. 350 VA
Housing	Aluminium
Dimensions	W 263 x H 263 x D 327.5 mm
Weight	Approx. 15 kg
Ambient temperature (Ambient)	-55°C ... +55°C
Oil temperature	-20°C ... +90°C
Oil Pressure	up to 800 kpa (negative pressure allowed)
Connection to valve	DIN ISO 228: G 1½ Optional: NPT 1½
Safety	CE certified
Isolation protection	IEC 61010-1:2002
Degree of protection	IP-55

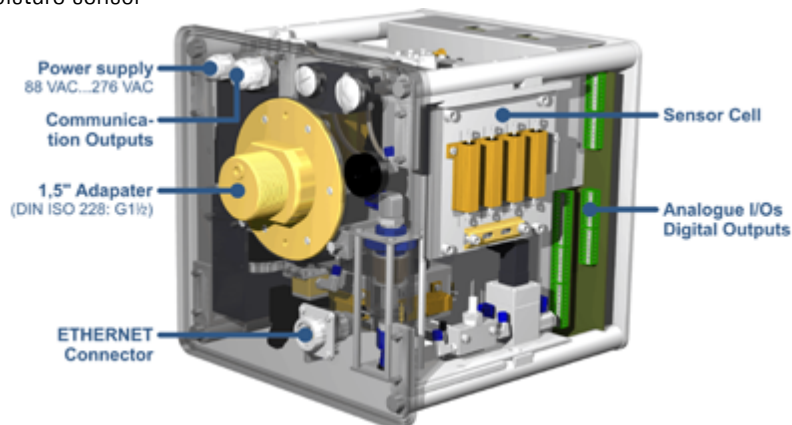
Measurements

Gas/Humidity-in-Oil Measurement		
Measuring Quantity	Range	Accuracy
Hydrogen H ₂	0 ... 2.000 ppm	± 15 % ± 25 ppm
Carb. Monoxide CO	0 ... 5.000 ppm	± 20 % ± 25 ppm
Carb. Dioxide CO ₂	0 ... 20.000 ppm	± 20 % ± 25 ppm
Methane CH ₄	0 ... 2.000 ppm	± 20 % ± 25 ppm
Acetylene C ₂ H ₂	0 ... 2.000 ppm	± 20 % ± 5 ppm
Ethylene C ₂ H ₄	0 ... 2.000 ppm	± 20 % ± 10 ppm
Ethane C ₂ H ₆	0 ... 2.000 ppm	± 20 % ± 15 ppm
Moisture	0 ... 100 ppm	± 3 % ± 3 ppm

Operation Principle

- Miniaturized gas sample production based on headspace principle (no membrane, negative pressure-proof)
- Patent-pending oil sampling system (EP 1 950 560 A1)
- Infrared NIR gas sensor unit for CO, C₂H₂ and C₂H₄
- Micro-electronic gas sensor for H₂
- Thin-film capacitive moisture sensor

Connections



Analogue and Digital Outputs (standard)

Analogue DC Outputs		Default functions	Alternative functions
Type	Range		
Current DC	0/4 ... 20 mADC	H ₂ Con.	Free config.
Current DC	0/4 ... 20 mADC	CO Con.	Free config.
Current DC	0/4 ... 20 mADC	CO ₂ Con.	Free config.
Current DC	0/4 ... 20 mADC	CH ₄ Con.	Free config.
Current DC	0/4 ... 20 mADC	C ₂ H ₂ Con.	Free config.
Current DC	0/4 ... 20 mADC	C ₂ H ₄ Con.	Free config.
Current DC	0/4 ... 20 mADC	C ₂ H ₆ Con.	Free config.
Current DC	0/4 ... 20 mADC	Moisture Con.	Free config.

Digital Outputs		Max. Switching Capacity
Type	Control Voltage	
Relay	5 x 12 VDC	220 VDC/VAC / 2 A / 60 W

Analogue Inputs and Digital Outputs (optional)

Analogue DC Inputs (External sensors)		Accuracy	Remarks
Type	Range	of the measuring value	
Current	4 x 0/4 ... 20 mADC	≤ 0.5 %	

Analogue AC Inputs (Cap. HV Bushing)		Accuracy	Remarks
Type	Range	of the measuring value	
Voltage or Current	6 x 0 ... 80 V+20% 6 x 0/4 ... 20 mA+20%	≤ 1.0 %	Configurable via jumper

Digital Outputs		Max. Switching Capacity
Type	Control Voltage	
Opto-coupler	5 x 5 VDC	UCE: 4 V (rated) / 35 V (max.) UEC: 7 V (max.) UCE: 40 mA (max.)

Analogue Outputs Communication

- ETHERNET 10/100 Mbit/s (copper-wired or fibre-optical)
- RS 485 (proprietary or MODBUS protocol)
- On-board GSM or analog modem (optional)