

## Technical data HYDROCAL 1005

### General

Auxiliary supply:	88 VAC <sub>min</sub> ... 276 VAC <sub>max</sub> Optional: 88 VDC <sub>min</sub> ... 350 VDC <sub>max</sub>
Power consumption:	max. 350 VA
Housing:	Aluminium
Dimensions:	W 263 x H 263 x D 327.5 mm
Weight:	Approx. 13.5 kg
Operation temperature: (ambient)	-55 °C ... +55 °C
Oil temperature: (inside transformer)	-20 °C ... +90 °C
Oil Pressure:	up to 800 kpa (negative pressure permitted)
Connection to valve:	DIN ISO 228: G 1½ Optional: NPT 1½

### Safety

Isolation protection:	IEC 61010-1:2002
Degree of protection:	IP-55

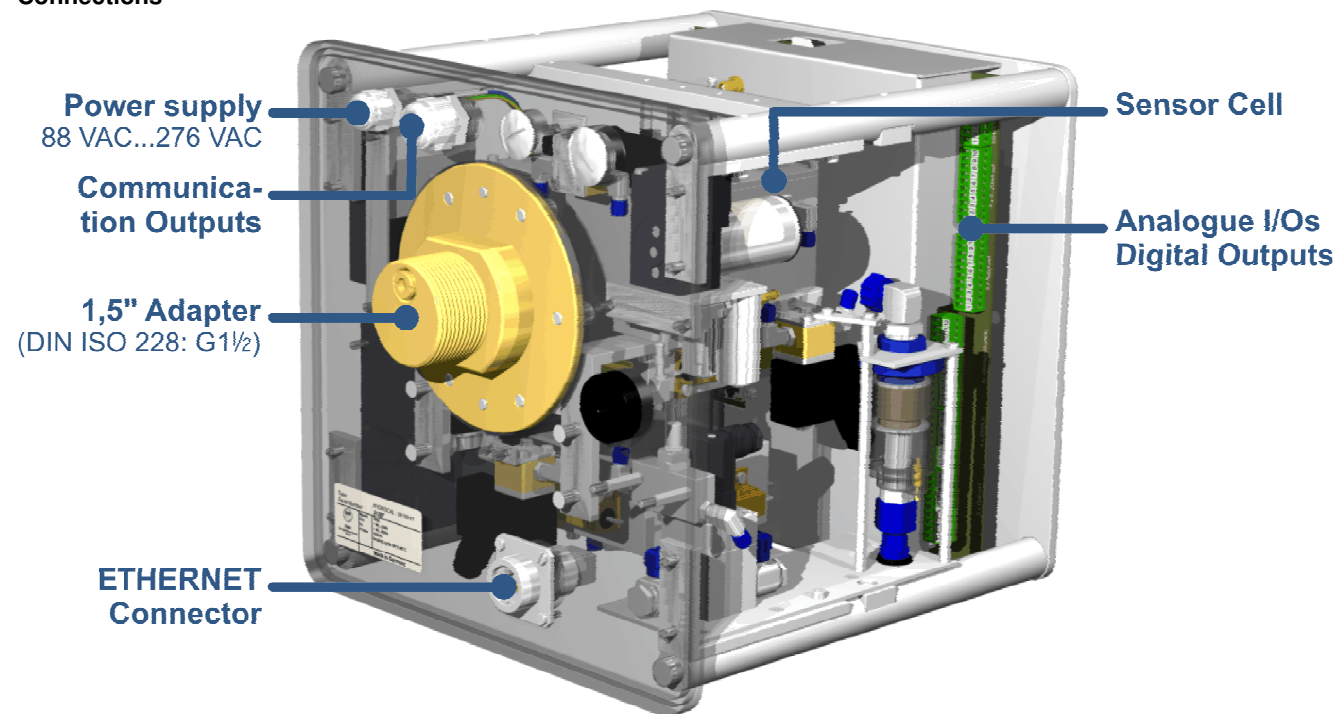
### Measurements

Gas/Humidity-in-Oil Measurement		
Measuring Quantity	Range	Accuracy
Hydrogen H <sub>2</sub>	0 ... 2.000 ppm	± 15 % ± 25 ppm
Carb. Monoxide CO	0 ... 5.000 ppm	± 20 % ± 25 ppm
Acetylene C <sub>2</sub> H <sub>2</sub>	0 ... 2.000 ppm	± 20 % ± 5 ppm
Ethylene C <sub>2</sub> H <sub>4</sub>	0 ... 2.000 ppm	± 20 % ± 10 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, C<sub>2</sub>H<sub>2</sub> and C<sub>2</sub>H<sub>4</sub>
- Micro-electronic gas sensor for H<sub>2</sub>
- 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 <sub>2</sub> Con.	Free config.
Current DC	0/4 ... 20 mADC	CO Con.	Free config.
Current DC	0/4 ... 20 mADC	C <sub>2</sub> H <sub>2</sub> Con.	Free config.
Current DC	0/4 ... 20 mADC	C <sub>2</sub> H <sub>4</sub> Con.	Free config.
Current DC	0/4 ... 20 mADC	Moisture Con.	Free config.

Digital Outputs		
Type	Control Voltage	Max. Switching Capacity
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		
Type	Control Voltage	Max. Switching Capacity
Opto-coupler	5 x 5 VDC	U <sub>CE</sub> : 4 V (rated) / 35 V (max.) U <sub>EC</sub> : 7 V (max.) U <sub>CE</sub> : 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)

# MTE Meter Test Equipment

## HYDROCAL 1005

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



The HYDROCAL 1005 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<sub>2</sub>), carbon monoxide (CO), acetylene (C<sub>2</sub>H<sub>2</sub>) and ethylene (C<sub>2</sub>H<sub>4</sub>) dissolved in transformer oil.

As hydrogen (H<sub>2</sub>) 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<sub>2</sub>H<sub>2</sub>) and ethylene (C<sub>2</sub>H<sub>4</sub>) 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 0/4-20 mADC
- 6 analog inputs 0/4-20 mADC +20% / 0-80 VAC +20% 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):

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

### Key Advantages

- Hydrogen (H<sub>2</sub>), Carbon monoxide (CO), acetylene (C<sub>2</sub>H<sub>2</sub>) and ethylene (C<sub>2</sub>H<sub>4</sub>) measurement
- Moisture-in-oil measurement
- Communication interfaces ETHERNET 10/100 Mbit/s (copper-wired or 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 current inputs for the connection of capacitive HV bushing sensors for HV bushing monitoring applications

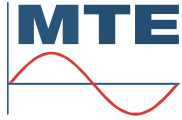
MTE Meter Test Equipment AG

Subject to alterations



Dammstrasse 16 • P.O. box 4544 • 6304 Zug • Switzerland  
Phone +41-41-724 24 48 • Fax +41-41-724 24 25 • Internet www.mte.ch

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## Transformer monitoring functions

### Voltages and Currents

(via voltage and current transformers / transducer)

### Temperature Monitoring

Bottom and oil temperature  
(via additional temperatures sensors)

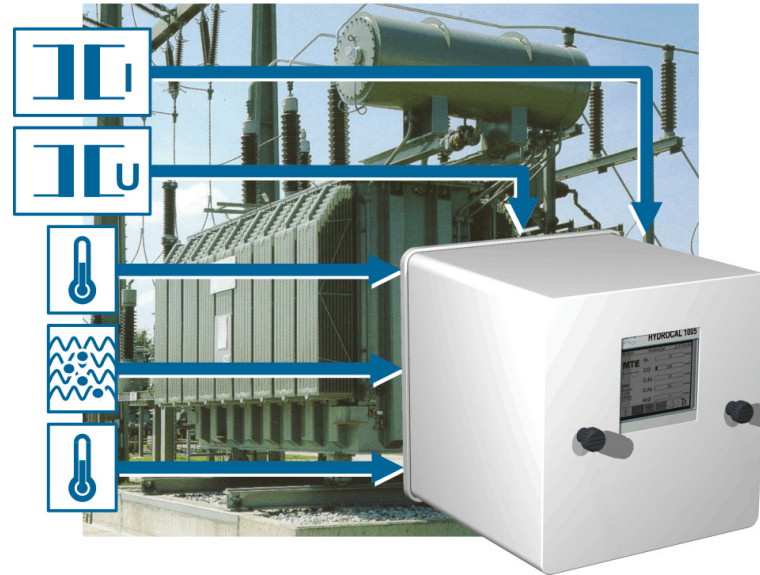
### Free configuration

Analogue inputs can be free allocated to any additional sensor

### Further Calculations:

Hot-Spot (acc. IEC 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



## Sensor firmware main menu

### User menu

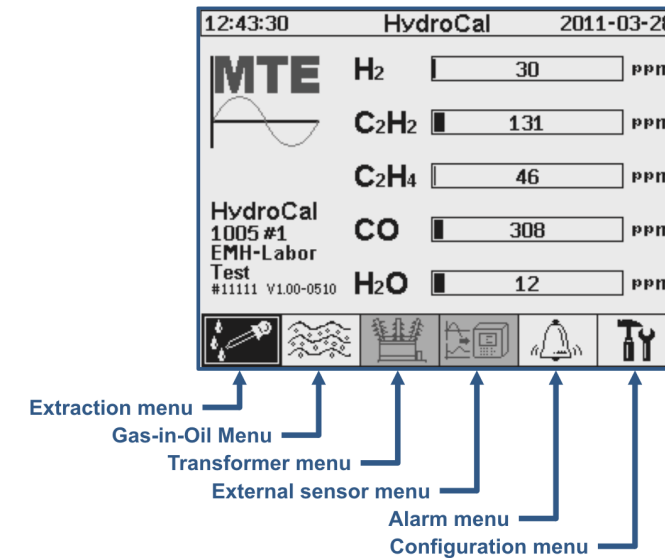
- Transformer administrator data
- Customer / Site administrator data

### Gas-in-Oil menu

- Chart diagram
- Result table

### Transformer menu

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



### External menu

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

### Alarm menu

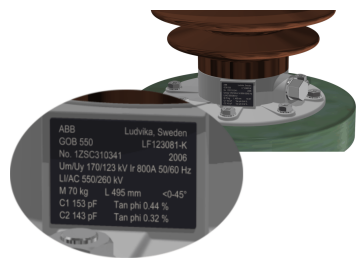
- Report table
- Alarm acknowledgement

### Configuration menu

- Alarm level setting
- Communication setting
- Transformer setting Installation

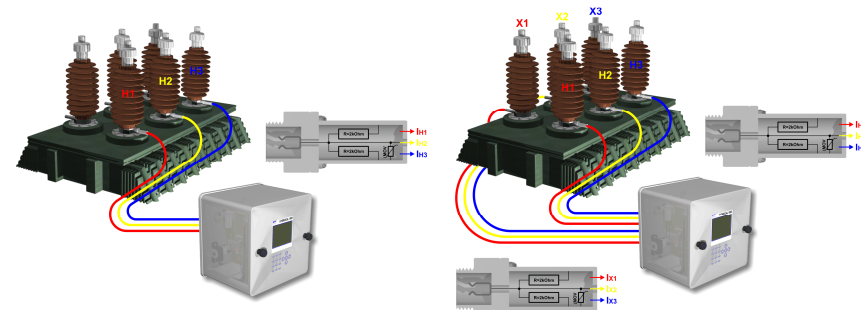
## HV Bushing Monitoring

### HV Bushing / Test tap / Name plate



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

### Test methods: Leakage current Sum of currents

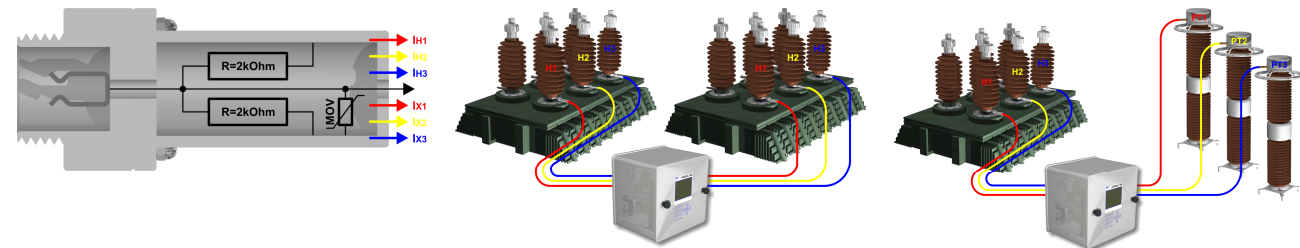


### Bushing sensor

(joint development with ZTZ Services International, USA)



### Test method: tanδ (dissipation factor) PF (power factor)



### Operation principle

**Resistive Bridge**

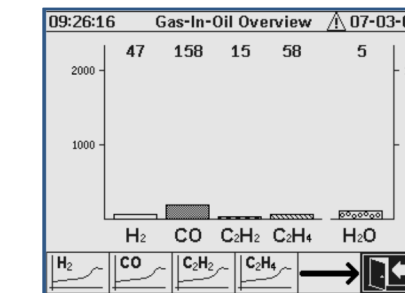
Voltage range 69 kV – 765 kV AC (Bushing / Primary)  
Max. 2.5 kV AC (Sensor / Secondary)

Current range 0 – 140 mA AC

Thread 0.75" / 1.25" / 2.25"

(other configurations available upon request)

## Gas-in-Oil overview menu



Individual chart diagram for hydrogen (H<sub>2</sub>), carbon monoxide (CO), acetylene (C<sub>2</sub>H<sub>2</sub>), ethylene (C<sub>2</sub>H<sub>4</sub>) and moisture.

## Alarm setup / edit menu

09:26:41 Alert Overview 07-03-04

#	Name	Date/Time	Status
1	H2-Alert(#1)	04-07-13:02	🔔
2	CO-Alert(#2)	04-06-12:15	🔔
3	C2H2-Alert(#3)	04-06-12:15	🔔
4	C2H4-Alert(#4)	04-06-12:15	🔔
5	H2O-Alert(#5)	04-06-12:15	🔔

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

## Bushing monitoring setup menu

09:51:42 Bushing Monitoring 2007-06-05

**Bushing Monitoring Setup**

Frequency [Hz]: 50

HV Bushing Voltage [kV]: 380

LV Bushing Voltage [kV]: 110

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

