



## HYDROCAL 1001+

Composite Gas-in-Oil Sensor with Moisture in Oil Measurement



The HYDROCAL 1001+ is a permanently installed composite gas-in-oil sensor for the analysis of the following dissolved key fault gases (TDCG = **T**otal **D**issolved **C**ombustible **G**ases):

<b>Fault gas</b>	<b>TDCG contribution</b>
Hydrogen (H <sub>2</sub> )	approx. 20 %
Carbon Monoxide (CO)	approx. 30 %
Methane (CH <sub>4</sub> )	< 5 %
Acetylene (C <sub>2</sub> H <sub>2</sub> )	100 %
Ethylene (C <sub>2</sub> H <sub>4</sub> )	approx. 32 %
Ethane (C <sub>2</sub> H <sub>6</sub> )	< 5 %

To provide an even more comprehensive transformer monitoring solution, the HYDROCAL 1001+ analyses additionally the content of Moisture (H<sub>2</sub>O) in the transformer oil.

The integration of 6 relevant key gases into a total weighted gas concentration and the measurement of Moisture in oil enables the HYDROCAL 1001+ to react to most transformer faults and makes the device to a compact and cost effective tool used in particular for early transformer fault detection and preventative maintenance.

The HYDROCAL 1001+ is equipped with 2 analog 0/4 ... 20 mA outputs for the dissolved composite gas-in-oil and moisture in oil analysis results and 4 digital relay outputs (Hi-alarm, Hi-Hi-alarm, Moisture-alarm and system function alarm)

### Key advantages:

- Composite measurement of Hydrogen (H<sub>2</sub>), Carbon Monoxide (CO), 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>) and dissolved Moisture (H<sub>2</sub>O) in the transformer oil
- Relay outputs with light indicators showing potential alerts
- Easy and fast installation without any operational interruption of the transformer
- Compact and resistant design for long lasting usage
- Communication interfaces ETHERNET 10/100Mbit/s (copper-wired or fibre-optical (Option)) and RS 485 to support proprietary communication protocols and sub-station communication protocols MODBUS<sup>®</sup>TCP

## General

Optional nominal voltages of auxiliary supply:	120 V -20% +15% AC 50/60 Hz <sup>1)</sup> or 230 V -20% +15% AC 50/60 Hz <sup>1)</sup> or 120 V -20% +15% DC <sup>1)</sup> or 230 V -20% +15% DC <sup>1)</sup> Other nominal voltages on request!
Power consumption:	max. 250 VA
Housing:	Aluminium
Dimensions:	W 224 x H 195 x D 218 mm
Weight:	approx. 4 kg
Operation temperature (ambient):	-55°C ... +55°C
Oil temperature (inside Transformer):	-20°C ... +90°C
Storage temperature (ambient):	-20°C ... +65°C
Oil pressure:	Up to 800 kpa (no negative pressure allowed)
Connection to valve:	G 1½" DIN ISO 228-1 or 1½" NPT ANSI B 1.20.1

## Safety

Insulation protection:	IEC 61010-1
Degree of protection:	IP-55

## Measurements

Gas-in-oil measurement			
Measuring Quantity	Range	Accuracy <sup>2) 3)</sup>	TDCG-Contribution
TDCG	0 ... 5.000 ppm	± 15 % ± 20 ppm	
Hydrogen H <sub>2</sub>		± 10 % ± 15 ppm	approx. 20 %
Carbon Monoxide CO		± 20 % ± 25 ppm	approx. 30 %
Methane CH <sub>4</sub>		± 20 % ± 25 ppm	< 5 %
Acetylene C <sub>2</sub> H <sub>2</sub>		± 20 % ± 25 ppm	100 %
Ethylene C <sub>2</sub> H <sub>4</sub>		± 20 % ± 25 ppm	approx. 32 %
Ethane C <sub>2</sub> H <sub>6</sub>		± 20 % ± 25 ppm	< 5 %
Moisture H <sub>2</sub> O (aw)	0 ... 100 %	± 3 %	
Moisture in Mineral Oil	0 ... 100 ppm	± 3 % ± 3 ppm	
Moisture in synt. Ester <sup>5)</sup>	0 ... 2.000 ppm	± 3 % of MSC <sup>6)</sup>	
Measurement cycle	20 min		

<sup>5)</sup>Option <sup>6)</sup>Moisture Saturation Content

## Analog and digital outputs

2 x Analog DC output		
Type	Control range	Default function (Free assignment)
1 x Current DC	0/4 ... 20 mADC	TDCG Concentration
1 x Current DC	0/4 ... 20 mADC	Moisture in oil H <sub>2</sub> O Concentration

4 x Digital outputs		
Type	Control voltage	Max. Switching capacity
4 x Relay <sup>4)</sup>	12 VDC	220 VDC/VAC / 2 A / 60 W

## Communication

- ETHERNET 10/100 Mbit/s modem copper-wired / RJ 45 (proprietary or MODBUS<sup>®</sup> TCP protocol)
- ETHERNET 10/100 Mbit/s modem fibre-optical / SC Duplex (proprietary or MODBUS<sup>®</sup> TCP protocol) (Option)
- RS 485

## Operation principle

- Diffusion principle with gas-permeable TEFLON membrane
- Fuel cell-gas sensor for H<sub>2</sub>, CO, CH<sub>4</sub>, C<sub>2</sub>H<sub>2</sub>, C<sub>2</sub>H<sub>4</sub> and C<sub>2</sub>H<sub>6</sub>
- Thin-film capacitive moisture sensor for H<sub>2</sub>O measurement

## Notes

- 120 V ⇒ 120 V -20% = 96 V<sub>min</sub>      120 V +15% = 138 V<sub>max</sub>  
230 V ⇒ 230 V -20% = 184 V<sub>min</sub>      230 V +15% = 264 V<sub>max</sub>
- Related to temperatures ambient +20°C and oil +55°C
- Accuracy for moisture in oil for mineral oil types
- Relay 1: Hi alarm / Relay 2: Hi-Hi alarm / Relay 3: Moisture alarm / Relay 4: System alarm

