

## HYDROTAP

### Multi-Gas-in-Oil Analysis System for Monitoring Tap Changer



The HYDROTAP is designed for multi-gas-in-oil analysis on a tap changer and on a transformer tank. This wall mounted system allows the individual measurement of Moisture ( $H_2O$ ) and the key gases Hydrogen ( $H_2$ ), Carbon Monoxide (CO), Carbon Dioxide ( $CO_2$ ), Methane ( $CH_4$ ), Acetylene ( $C_2H_2$ ), Ethylene ( $C_2H_4$ ) and Ethane ( $C_2H_6$ ) dissolved in the tap changer oil utilising a sampling system that samples oil from a tap changer.

As Hydrogen ( $H_2$ ) is involved in nearly every fault of the isolation system of power transformers and Carbon Monoxide (CO) / Carbon Dioxide ( $CO_2$ ) is a sign of degradation of the cellulosic / paper isolation the presence and increase of Acetylene ( $C_2H_2$ ), Methane ( $CH_4$ ), Ethylene ( $C_2H_4$ ) and Ethane ( $C_2H_6$ ) 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 +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):

- 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 ( $H_2O$ ) measurement
- Monitoring of tap changer and transformer tank for dissolved gas concentrations
- Communication interfaces ETHERNET 10/100 Mbit/s (copper-wired / RJ 45 or fibre-optical / SC Duplex) and RS 485 to support proprietary communication protocols and to be open / prepared for substation communication protocols IEC 61850, MODBUS, TCP and DNP 3.0 etc.
- Optional on-board GSM and analog modems for remote communication

## 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. 350 VA
Housing:	Aluminium
Dimensions:	W 600 x H 800 x D 300 mm
Weight:	approx. 80 kg
Operation temperature: (Ambient)	-55°C ... +55°C
Oil temperature: (inside transformer)	-20°C ... +90°C
Oil pressure:	0 - 800 kpa (negative pressure allowed)
Mounting:	Wall mounted enclosure
Application:	Designed to monitor a tap changer and a transformer tank
Sampling sequence:	User configurable

## Safety

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

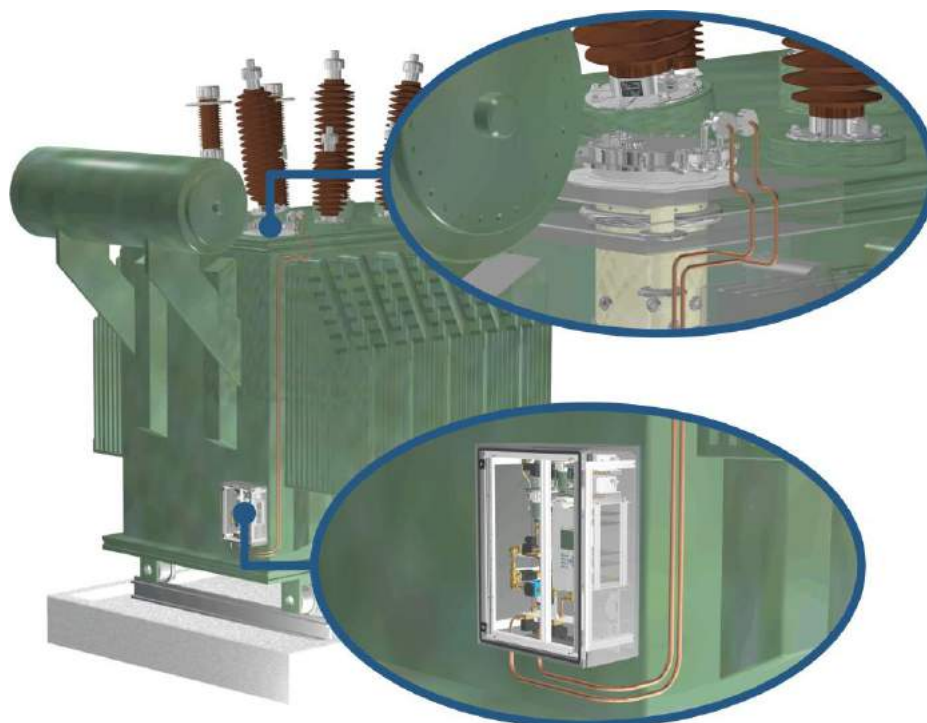
## Measurements

Gas / Humidity-in-oil measurement		Accuracy <sup>2) 3)</sup>
Measuring quantity	Range	
Hydrogen H <sub>2</sub>	0 ... 2.000 ppm	± 15 % ± 25 ppm
Carbon Monoxide CO	0 ... 5.000 ppm	± 20 % ± 25 ppm
Carbon Dioxide CO <sub>2</sub>	0 ... 20.000 ppm	± 20 % ± 25 ppm
Methane CH <sub>4</sub>	0 ... 2.000 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
Ethane C <sub>2</sub> H <sub>6</sub>	0 ... 2.000 ppm	± 20 % ± 15 ppm
Moisture H <sub>2</sub> O	0 ... 100 ppm	± 3 % ± 3 ppm

## Operation principle

- Oil intake, sampling and flushing
- 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, CO<sub>2</sub>, 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>
- Micro-electronic gas sensor for H<sub>2</sub>
- Thin-film capacitive moisture sensor H<sub>2</sub>O

## Configuration



## Analog and digital outputs (standard)

Analog DC outputs		Default concentration (Free configurable)
Type	Range	
Current DC	0/4 ... 20 mADC	Hydrogen H <sub>2</sub>
Current DC	0/4 ... 20 mADC	Carbon Monoxide CO
Current DC	0/4 ... 20 mADC	Carbon Dioxide CO <sub>2</sub>
Current DC	0/4 ... 20 mADC	Methane CH <sub>4</sub>
Current DC	0/4 ... 20 mADC	Acetylene C <sub>2</sub> H <sub>2</sub>
Current DC	0/4 ... 20 mADC	Ethylene C <sub>2</sub> H <sub>4</sub>
Current DC	0/4 ... 20 mADC	Ethane C <sub>2</sub> H <sub>6</sub>
Current DC	0/4 ... 20 mADC	Moisture H <sub>2</sub> O

Digital outputs		Max. Switching capacity
Type	Control voltage	
8 x Relay	12 VDC	220 VDC/VAC / 2 A / 60 W

## Analog inputs and digital outputs (optional)

Analog DC inputs		Accuracy	Remarks
Type	Range	of the measuring value	
4 x Current DC	0/4 ... 20 mADC	≤ 0.5 %	

Analog AC inputs		Accuracy	Remarks
Type	Range	of the measuring value	
6 x Voltage AC or 6 x Current AC/DC	0 ... 80 VAC +20% 0/4 ... 20 mAAC / mADC +20%	≤ 1.0 %	Configurable via jumper

Digital outputs		Max. Switching capacity
Type	Control voltage	
5 x Opto-coupler	5 VDC	U <sub>CE</sub> : 4 V (rated) / 35 V (max.) U <sub>EC</sub> : 7 V (max.) I <sub>CE</sub> : 40 mA (max.)

## Communication

- ETHERNET 10/100 Mbit/s modem (copper-wired / RJ 45 or fibre-optical / SC Duplex)
- RS 485 (proprietary or MODBUS, TCP and DNP 3.0 protocol)
- On-board GSM or analog modem (option)

## Note

- <sup>1)</sup> 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>
- <sup>2)</sup> Related to temperatures ambient +20°C and oil +55°C
- <sup>3)</sup> Accuracy for moisture in oil for mineral oil types