

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 ¹⁾ or 230 V -20% +15% AC 50/60 Hz ¹⁾ or 120 V -20% +15% DC ¹⁾ or 230 V -20% +15% DC ¹⁾ 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

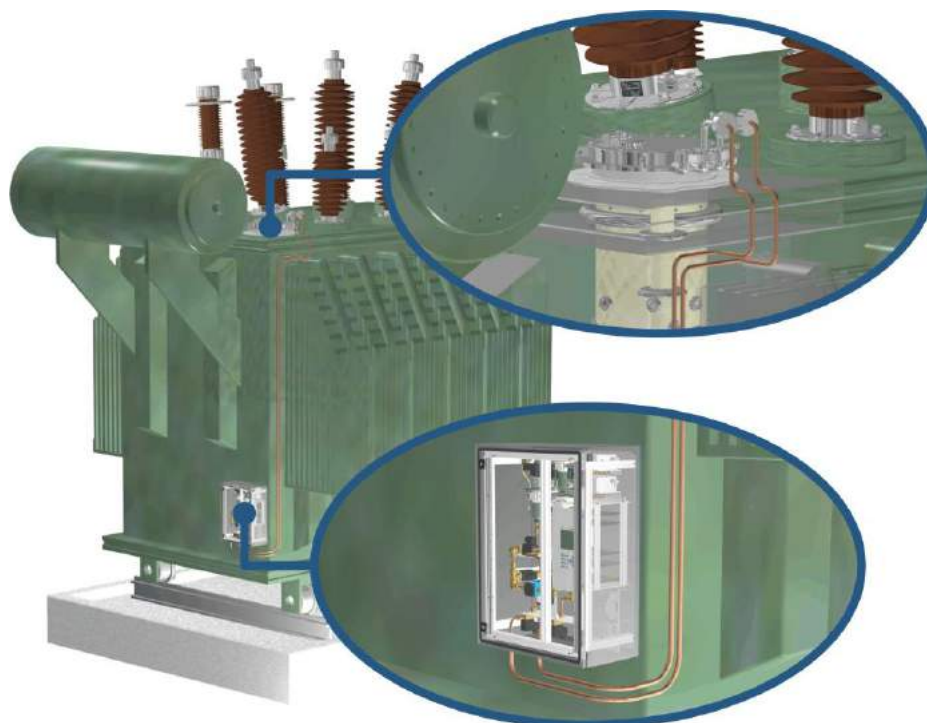
Measurements

Gas / Humidity-in-oil measurement		Accuracy ^{2) 3)}
Measuring quantity	Range	
Hydrogen H ₂	0 ... 2.000 ppm	± 15 % ± 25 ppm
Carbon Monoxide CO	0 ... 5.000 ppm	± 20 % ± 25 ppm
Carbon 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 H ₂ 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, CO₂, CH₄, C₂H₂, C₂H₄ and C₂H₆
- Micro-electronic gas sensor for H₂
- Thin-film capacitive moisture sensor H₂O

Configuration



Analog and digital outputs (standard)

Analog DC outputs		Default concentration (Free configurable)
Type	Range	
Current DC	0/4 ... 20 mADC	Hydrogen H ₂
Current DC	0/4 ... 20 mADC	Carbon Monoxide CO
Current DC	0/4 ... 20 mADC	Carbon Dioxide CO ₂
Current DC	0/4 ... 20 mADC	Methane CH ₄
Current DC	0/4 ... 20 mADC	Acetylene C ₂ H ₂
Current DC	0/4 ... 20 mADC	Ethylene C ₂ H ₄
Current DC	0/4 ... 20 mADC	Ethane C ₂ H ₆
Current DC	0/4 ... 20 mADC	Moisture H ₂ 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 _{CE} : 4 V (rated) / 35 V (max.) U _{EC} : 7 V (max.) I _{CE} : 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

- ¹⁾ 120 V ⇒ 120 V -20% = 96 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