MTE Meter Test Equipment

HYDROCAL 1005-3/-2/-1

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

The HYDROCAL 1005-3/-2/-1 is designed for multi-gas-in-oil analysis on a bank of three single phase transformers located next to each other. This new wall mounted system allows for the individual measurement of Moisture (H_2O) and the key gases Hydrogen (H_2), Carbon Monoxide (CO), Acetylene (C_2H_2) and Ethylene (C_2H_4) dissolved in transformer oil utilising a sampling system that samples oil from each tank via three separate oil channels expertly engineered to provide negligible mixing of 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 it's 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 alerts 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

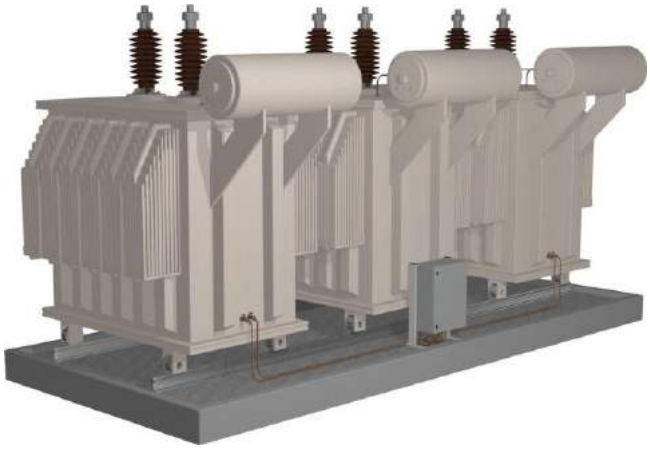
Key Advantages

- Hydrogen (H_2), Carbon Monoxide (CO), Acetylene (C_2H_2) and Ethylene (C_2H_4) measurement
- Moisture-in-Oil (H_2O) measurement
- Monitor three tanks with one HYDROCAL 1005-3/-2/-1
- 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
- Optional on-board GSM and analog modems for remote communication
- Optional capacitive HV bushing sensors for HV bushing monitoring applications via RS 485

Possible configuration of HYDROCAL 1005-3/-2/-1

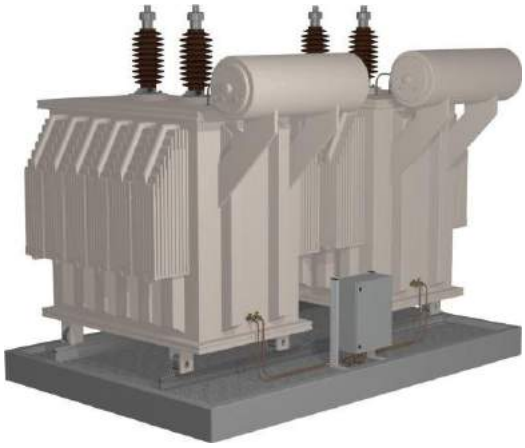
HYDROCAL 1005-3

To monitor a bank of three single phase transformers



HYDROCAL 1005-2

To monitor a bank of two single phase transformers



HYDROCAL 1005-1

To monitor a single phase transformer

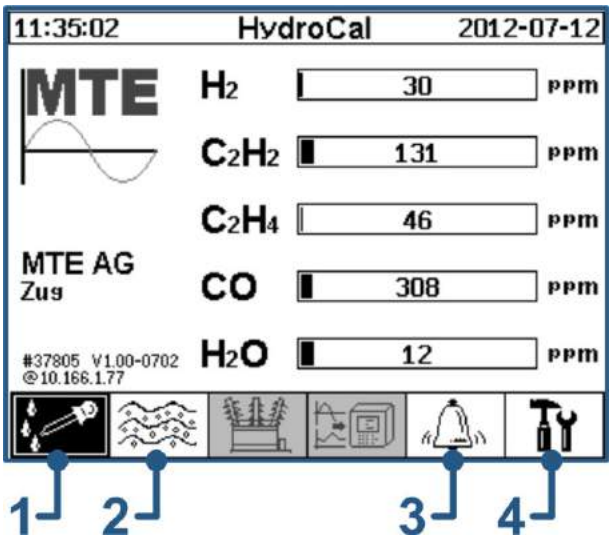
Sensor firmware main menu

1 Extraction Status

- Shows the actual operating status of the unit

2 Gas-in-Oil Overview

- Column Chart
- Trend Graph
- Data Table



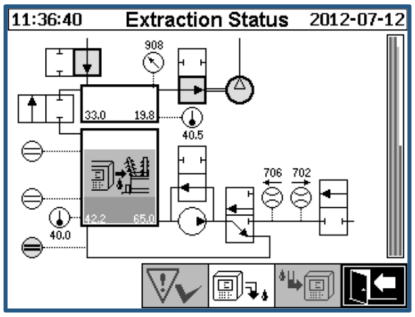
3 Alert Overview

- Alert acknowledgement
- Alert Table

4 Device Setup

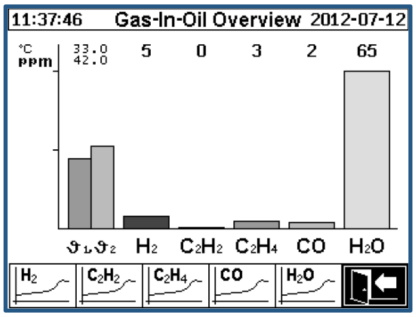
- Transformer related Setup
- Analog Output Setup
- External Sensors
- Alert-Level and Alert-Sensors
- HYDROCAL Setup

Extraction Status



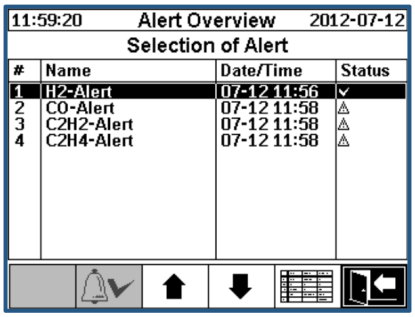
Status of each process steps and information of safety functions.

Gas-in-Oil Overview



Individual chart diagram for Hydrogen (H_2), Carbon Monoxide (CO), Acetylene (C_2H_2), Ethylene (C_2H_4) and Moisture (H_2O).

Alert Overview

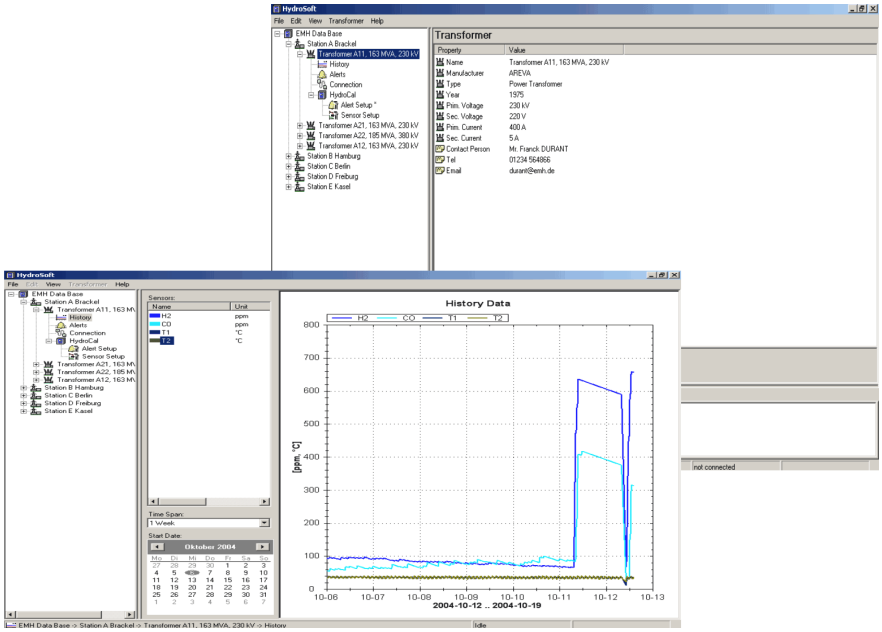


Display of alert list. Details of each alert and individual setting.

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 1005-3/-2/-1

General

Optional nominal voltages of auxiliary supply:	110 V (120 V) -20% +15% AC 50/60 Hz [1)] 220 V (240 V) -20% +15% AC 50/60 Hz [1)] 110 V (120 V) -20% +15% DC [1)] 220 V (240 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:	up to 800 kpa (negative pressure permitted)
Mounting:	Wall mounted enclosure
Application:	Designed to monitor up to three-phase transformer with separate tanks per phase
Sampling: sequence:	User configurable

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
Acetylene C_2H_2	0 ... 2.000 ppm	± 20 % ± 5 ppm
Ethylene C_2H_4	0 ... 2.000 ppm	± 20 % ± 10 ppm
Moisture-in-Oil H_2O	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, C_2H_2 and C_2H_4
- Micro-electronic gas sensor for H_2
- Thin-film capacitive moisture sensor H_2O

Connections

Analog and Digital Outputs

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	Acetylene C_2H_2
Current DC	0/4 ... 20 mADC	Ethylene C_2H_4
Current DC	0/4 ... 20 mADC	Moisture-in-Oil H_2O

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

Analog Inputs and Digital Outputs (Option)

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

Analog AC/DC 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		
Type	Control Voltage	**Max. Switching Capacity**
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 (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)

Notes[1)]

110 V (120 V) ⇨ 110 V -20% = **88 V_{min}** (120 V) +15% = **138 V_{max}**
220 V (240 V) ⇨ 220 V -20% = **176 V_{min}** (240 V) +15% = **276 V_{max}**