HYDROCAL 1008
Multi-Gas-in-Oil Analysis System with Transformer Monitoring Functions

The HYDROCAL 1008 is a permanently installed multi-gas-in-oil analysis system with transformer monitoring functions. It individually measures Moisture in Oil (H2O) and the key gases Hydrogen (H2), Carbon Monoxide (CO), Carbon Dioxide (CO2), Methane (CH4), Acetylene (C2H2), Ethylene (C2H4) and Ethane (C2H6) dissolved in transformer oil.

As Hydrogen (H2) is involved in nearly every fault of the insulation system of power transformers and Carbon Monoxide (CO) is a sign of an involvement of the cellulosic / paper insulation the presence and increase of Acetylene (C2H2) and Ethylene (C2H4) 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 optional analog inputs:

- 4 Analog inputs 0/4 ... 20mADC
- 6 Analog inputs 0/4 ... 20mAAC +20% or 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 optocoupler outputs (Option)

Key Advantages

- Individual measurement of Hydrogen (H2), Carbon Monoxide (CO), Carbon Dioxide (CO2), Methane (CH4), Acetylene (C2H2), Ethylene (C2H4) and Ethane (C2H6)
- Moisture in Oil (H2O) measurement
- Easy to mount on a transformer valve (G 1½" DIN ISO 228-1 or 1½" NPT ANSI B 1.20.1)
- Installation on the operational transformer without any operational interruption
- Advanced software (on the unit and via PC)
- Maintenance free system
- Communication interfaces ETHERNET 10/100 Mbit/s (copper-wired / RJ 45 or fibre-optical / SC Duplex) and RS 485 to support MODBUS®RTU/ASCII, MODBUS®TCP, DNP3 proprietary communication and IEC 61850 protocols
- Optional on-board GSM or analog modem for remote access
- Optional DNP3 serial modem for SCADA connection
- Optional IEC 61850 modem for SCADA connection
- Optional HV and LV bushing sensors for HV and LV bushing monitoring applications via communication interface
Transformer monitoring functions

VoItages and Currents
(via voltage and current transformers / transducer)

Temperature Monitoring
Bottom and top oil temperature, ambient temperature
(via additional temperature sensors)

Cooling Stage / Tap Changer Position
(e.g. via current transducer)

Free configuration
Analog inputs can be free allocated to any additional sensor

Further Calculations:
Hot-Spot (acc. IEC 60076) joint development
Loss-of-Life with PAUWELS
Ageing Rate

HV and LV Bushing monitoring functions (option)

The Bushing Monitoring System simultaneously monitors the bushing leakage current of 2, three phase groups of bushings. The Bushing Monitoring system incorporates three different measurement modes on each tested component to provide accurate Power Factor and Capacitance values to evaluate the condition of bushing insulation. The measurement modes are:

Phase comparison
Compares the power factor of tested component with another tested component energized with the same phase voltage

Sum of three current test
Measures the imbalance current from the summation of A, B and C phase currents from three tested components such as the three HV or LV bushings on the transformer

Adjacent phase reference test
compares the power factor of the tested components with other phase components on the same equipment

The bushing sensors / adapters are connected to the capacitor taps designed for all types of bushings to allow measurement of the leakage current up to 140 mA. The adapters are designed for bushings with grounded and undergrounded capacitor taps. The adapter is designed to prevent a voltage developing on the equipment should the sensor become disconnected from Bushing Monitoring System.

Different bushing sensor configurations possible:
- Monitoring of high voltage side
- Monitoring of high- and low voltage side
- Reference HV bushing from other transformers
- Reference CCVT / CCPT

Configuration with 3, 6, 9° or 12° bushing sensors possible.

Notes
1° Two Bushing Monitoring units necessary
HYDROCAL 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. Transformer specific measurements
   - Trend graph
   - Data table
   (to be included)

4. Additional sensor measurements
   - Trend graph
   - Data table
   (to be included)

5. Alert overview
   - Alert acknowledgement
   - Alert table

6. Device setup
   - Alert level setting
   - Communication setting
   - Transformer setting
   - In- and output setting

Extraction status: Shows the status of the actual process step and information of safety functions.

Gas-in-oil overview: Individual chart diagram for Hydrogen (H₂), Carbon Monoxide (CO), Carbon Dioxide (CO₂), Methane (CH₄), Acetylene (C₂H₂), Ethylene (C₂H₄) and Ethane (C₂H₆) and Moisture in Oil (H₂O) and temperatures.

Alert overview: Display of alarm list. Details of each alarm and individual settings is shown.

HydroSoft PC-Software

Program key features
- Configuration and administration of each individual HYDROCAL unit
- Data and configuration read out of HYDROCAL units
- Processing and presentation of data read out (trend or table)
- Online functions (online sensors, extraction status and process flow)
- Diagnostic functions (Duval triangle and Rogers 3D graphic)
- Further processing of the processed data (Excel, CSV, clipboard and printing)
- Storage of the processed data and unit configuration
- Automatic data read out and alerting by e-mail

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