MTE Meter Test Equipment

HYDROCAL BPD

Modular monitoring system for high voltage bushings and partial discharge analysis of bushings and power transformers

HYDROCAL BPD is a modular online monitoring system for high voltage bushings as well as partial discharge of bushings and the active part of power transformers. Bushing monitoring supports the measurements of voltage, current and phase angle on the test tap to derive tan δ / PF and bushing capacitance as well as electrical partial discharge measurement acc. IEC 60270. For the partial discharge analysis within the active part of high voltage power transformers UHF (ultra-high frequency) measurement is supported.

HYDROCAL BPD can be combined with other HYDROCAL models, preferably HYDROCAL genX, to set up a comprehensive monitoring system.

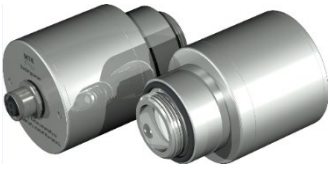
As per CIGRÉ Working Group A2.37 bushings resp. the lead exit represent the 2nd largest group of transformer failure locations (approx. 25 %) after the windings (43 %) and before the tap changer (23 %) therefore bushing monitoring can help to reduce those failures whereas UHF partial discharge analysis of the active part of a power transformer is an ideal combination with online DGA performed by the HYDROCAL product family.

The modular concept of HYDROCAL BPD allows the user to select the combination of bushing monitoring and partial discharge functions that suits best to its monitoring needs and technology convictions. Whereas the measurement of voltage and phase on the test tap of high voltage bushings allows to compare tan δ / PF with factory test results the partial discharge analysis could help to detect electrical failures of those bushings faster. UHF (ultra-high frequency) partial discharge analysis of the active part of large power transformers can be a good method to determine winding or other electrical failures without disturbances e.g. by corona.

Key Advantages

- Monitoring of capacitance, tan δ / PF and partial discharge (acc. IEC 60270) of up to six high voltage bushings
- UHF partial discharge analysis of up to six different positions of the active part of power transformers
- Advanced software (on the unit and via PC) with intuitive operation by 7” color TFT capacitive touch screen, WLAN and web server operation from any smartphone, tablet or notebook PC
- Communication interfaces Wi-Fi, USB or Ethernet 10/100 Mbit/s
- SD memory card for test results, history and diagnostic data of power transformers
- Optional SSD storage for partial discharge measurement details in high resolution
- Maintenance free system
- Optional 4G modem with external adhesive antenna
- Optional DNP3 protocol for SCADA connection
- Optional IEC 61850 protocol for SCADA connection

Bushing sensors for electrical PD



Capacitance (C), tan δ, power factor (PF) / partial discharge (PD)

C voltage range	0 V … 28 V
C frequency range	1 Hz … 100 kHz
PD measuring range	1 pC … 30 nC
PD frequency range	100 KHz … 2.75 MHz

Alternative design electrical PD

Bushing sensors

Different designs of bushing sensors available according to bushing types and manufacturers

Partial discharge sensors for electrical PD

Clamp-on HFCT for electrical PD measurement

Measuring range	1 pC … 30 nC
Bandwidth	800 KHz … 28 MHz

Partial discharge sensors for UHF PD

UHF plate sensor

Measuring range	-60 dBm … 0 dBm
Bandwidth	100 MHz … 3 GHz

Partial discharge sensors for UHF PD

UHF drain valve sensor 50

Measuring range	-60 dBm … 0 dBm
Bandwidth	100 MHz … 3 GHz

Partial discharge sensors for UHF PD

UHF drain valve sensor 25

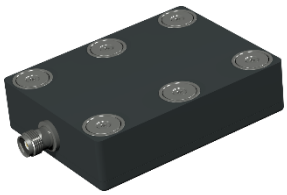
Measuring range	-60 dBm … 0 dBm
Bandwidth	100 MHz … 3 GHz

Acoustic PD sensor

Ultrasound sensor for PD detection and localization

Dynamic range	87 dB
Bandwidth	50 kHz … 400 kHz

TEV PD sensor

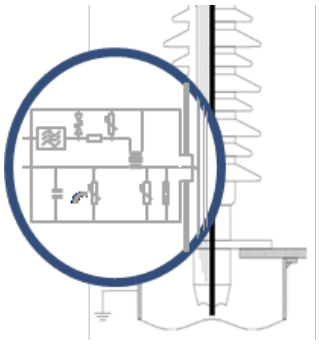


Capacitive transient earth voltage PD sensor

Displacement force using magnet mount*	50 N
Bandwidth	5 MHz … 100 MHz

* On 10 mm S235JR steel plate with paint thickness < 400 µm

HYDROCAL BPD sensors



Safety concept

Typical risk of “adapter type” sensors:
“High Voltage” on bushing test tap cable if circuit is not grounded.

We use a safe design for our HYDROCAL bushing sensors:

- Measurement capacitance integrated into bushing sensor
- Sensor capable of capacitance, tan δ and PD measurements
- “State of the art” overvoltage concept
- Gas discharge tubes (GDT) for high impulse energy
- Suppressor diodes / varistors for fast discharge

Our **safe design ensures that the bushing test tap cable remains de-energized even if cut or damaged.** Permanent grounding ensures the system remains as safe as if the protective cap were installed.

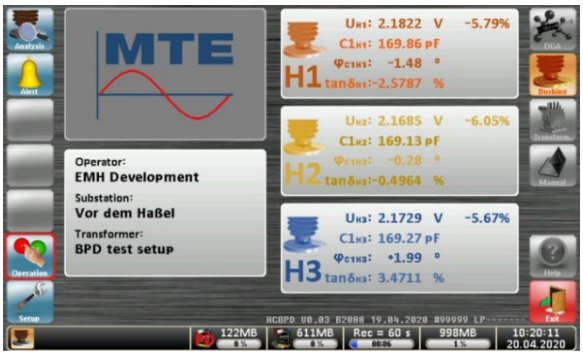
Software HYDROCAL BPD

Analysis: Chart, graph, table, polar and PRPD presentation

Alert: Configuration, report, protocol and acknowledgement of alerts

Operation: Start, stop and configuration of measurement / recording

Setup: Communication, time / date, language and other configurations



Dissolved Gas Analysis: Setup, operation, alert functions and modes

Bushing monitoring: Setup, operation, alert functions and modes

Transformer monitoring: Setup, operation, alert functions and modes

Manual: Scrolling through / display of all chapters of the manual

Help: Automatic switching to the relevant page of the manual

Exit: Closing / returning to the previous function / step within all operation menus

Bushing parameter configuration summary

U | C | ϕ | tan δ measurement

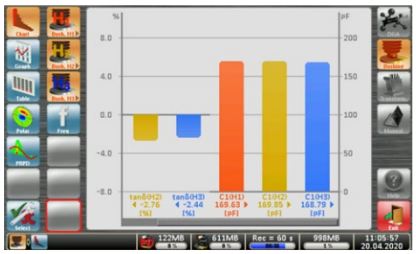
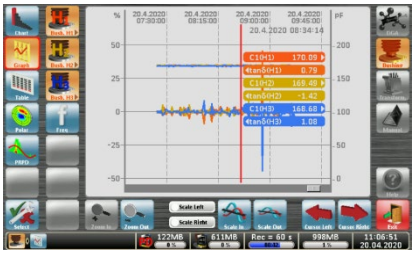
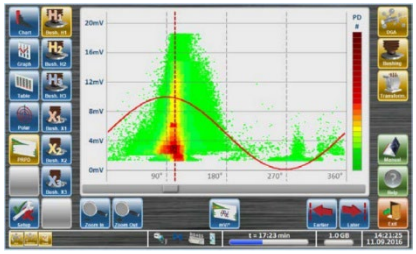


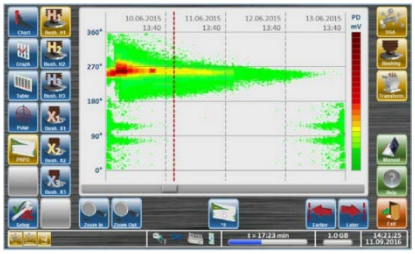
Chart display



Graph display



PRPD
(**P**hase **R**esolved **P**artial **D**ischarge)



TRPD
(**T**ime **R**esolved **P**artial **D**ischarge)

Technical data HYDROCAL BPD

General

Auxiliary power supply:	85 VAC_{min} ... 264 VAC_{max} 90 VDC_{min} ... 350 VDC_{max}	
Operation frequency:	45 Hz … 65 Hz	
Power consumption:	max. 100 VA	
Operation temperature: (ambient)	-55 °C ... +50 °C	
Storage temperature: (ambient)	-20 °C ... +55 °C	
Relative humidity:	≤ 85 % at Ta ≤ 21 °C	
	≤ 95 % at Ta ≤ 25 °C, 30 days / year spread	
Operation altitude:	max. 2000 m	
	HYDROCAL BPD	**Cabinet**
Housing:	Hard plastic	Stainless steel
Dimensions (W x H x D):	400 x 260 x 97 mm (instrument only) 550 x 570 x 102 mm (on mounting plate)	600 x 600 x 210 mm
Weight:	approx. 10 kg	approx. 23 kg
Degree of protection:	IP-40	IP-66
Corrosion protection:	C1/2	C5M
Display:	7" color (800 x 600 pixels) TFT touch screen	
Memory:	SD memory card (removable) up to 64 GB SSD drive (PD option incl.) up to 256 GB	

EMC	CE
EMC Interference and Emission Standard	EN 61326-1
EMC Interference Immunity Standard	EN 61000-6-5
EMC Emission Standard	EN 61000-6-4

Safety	CE
Insulation protection:	EN 61010-1: Overvoltage category II
Electrical protection class:	EN 61140: Class I

Measurements

Capacitance (C) / tan δ / Power factor (PF)

Measuring quantity	Voltage	Phase angle	Frequency	Reference voltage
Measuring range:	0 V ... 28 V	0 ° … 360 °	40 Hz … 70 Hz	50 V … 300 V
Uncertainty:	≤ ±0.1 %	≤ ±0.01 °	≤ ±0.01 Hz	≤ ±0.1 %
Resolution:	14 bits			
Current range	0 … 200mA			
Sampling rate:	50 kHz			
Sensors:	Bushing tap sensor			PT
Input channels:	Up to 6			Up to 3

Partial Discharge (PD)

Electrical PD acc. IEC 60270

Measuring quantity	Partial discharge
Measuring range:	1 pC … 30 nC
Frequency:	100 kHz … 10 MHz
Frequency ranges:	100 kHz … 500 kHz, 500 kHz … 900 kHz, 1.25 MHz … 1.75 MHz, 2.25 MHz … 2.75 MHz.
Resolution:	12 bits
Sampling rate:	1° phase resolution for 50 Hz & 60 Hz systems (18 kS/s & 21.6 kS/s)
Sensors:	Bushing tap sensor
Input channels:	Up to 6

Ultra-High Frequency (UHF)

Measuring quantity	Partial discharge
Measuring range:	-75 dBm … -5 dBm
Frequency:	200 MHz … 3 GHz
Resolution:	12 bits
Sampling rate:	1° phase resolution for 50 Hz & 60 Hz systems (18 kS/s & 21.6 kS/s)
Sensors:	UHF Drain valve sensor UHF Plate sensor
Input channels:	Up to 6

Digital outputs

4 x digital outputs		**Max. switching capacity** (free assignment)
Type	Control voltage	
4 x relay	12 VDC	220 VDC / VAC / 2 A / 60 W

Communication

- 2 x USB (type A and type B)
- 2 x RS 485 (proprietary or MODBUS® RTU / ASCII protocol)
- Ethernet 10/100 Mbit/s copper-wired / RJ 45 or fibre-optical / SC Duplex (proprietary or MODBUS® TCP protocol)
- Wi-Fi (genX web server)

Options

- 2nd Ethernet 10/100 Mbit/s copper-wired / RJ 45 or fibre-optical / SC Duplex (proprietary or MODBUS® TCP protocol and PRP)
- 4G modem with external adhesive antenna
- DNP3 protocol
- IEC 61850 protocol

Connections