

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 both the measurement of voltage and phase angle on the test tap to derive $\tan \delta$ /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 angle on the test tap of high voltage bushings allows to compare $\tan \delta$ /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, $\tan \delta$ /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 touchscreen, WLAN and web server operation from any smart phone, 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

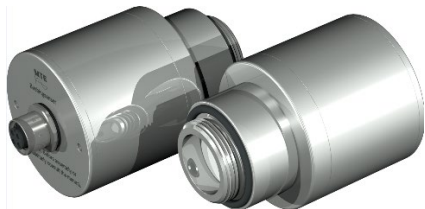


Bushing Sensors

Capacitance (C) $\tan \delta$ / Power factor (PF)

Measuring range: 0 V ... 28 V

Frequency range: 1 Hz ... 100 kHz



Partial Discharge

Measuring range: 1 pC ... 30 nC

Bandwidth: 100 KHz ... 2.75 MHz



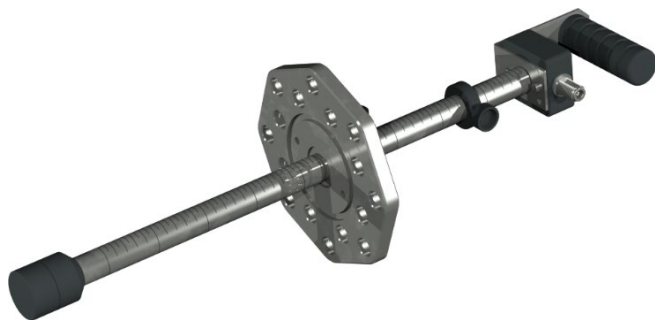
* Different designs available according to bushing types and manufacturers (see below)

Partial Discharge Sensors UHF PD

UHF Drain valve sensor

Measuring range: -60 dBm ... 0 dBm

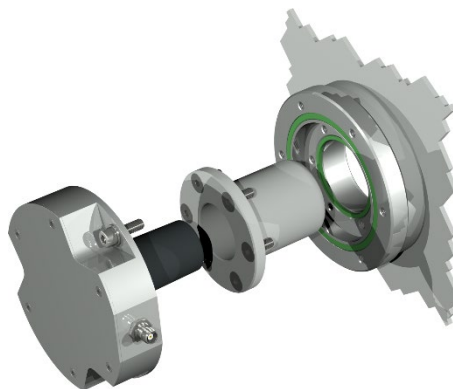
Bandwidth: 100 MHz ... 3 GHz



UHF Plate sensor

Measuring range: -60 dBm ... 0 dBm

Bandwidth: 100 MHz ... 3 GHz

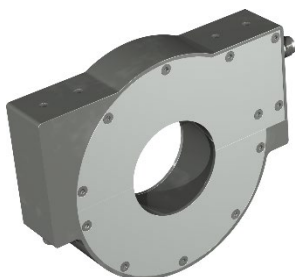


Partial Discharge Sensors Electrical PD

Clamp-on HFCT for Electrical PD Measurement

Measuring range: 1 pC ... 30 nC

Bandwidth: 800 KHz ... 28 MHz



Bushing sensors (alternative designs)

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





Software HYDROCAL BPD



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



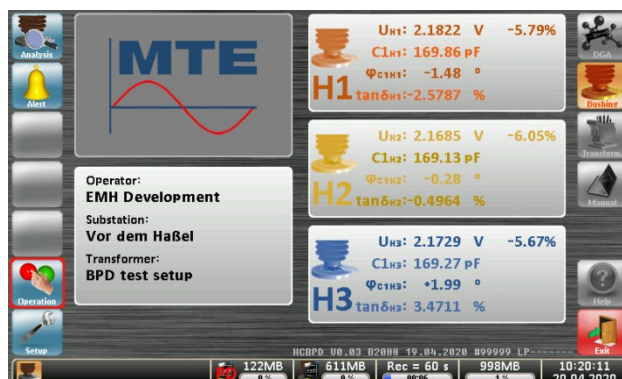
Alert: Configuration, report, protocol and acknowledgement of alerts



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

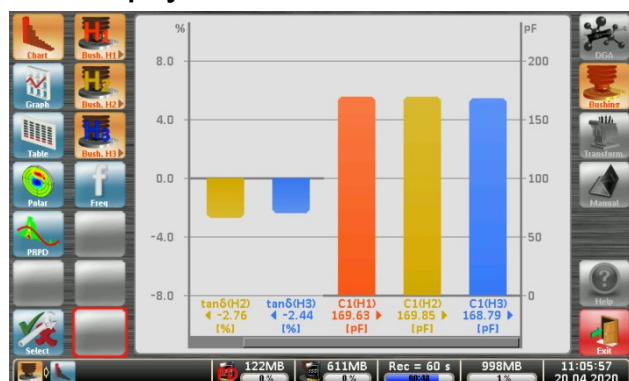
Bushing	C	tanδ	Manuf.	Type	Ref.	Uprim.	Usec.	Offset	PD
H1	165.00 PF	0.3200 %	TRENCH	COT 1245-1000	Ref.U1	110.00 k	110.00	100.00m	✓
H2	165.00 PF	0.3200 %	TRENCH	COT 1245-1000	Ref.U2	110.00 k	110.00	100.00m	✓
H3	165.00 PF	0.3200 %	TRENCH	COT 1245-1000	Ref.U3	110.00 k	110.00	100.00m	✓
H4	153.00 PF	0.4100 %	ABB	Gob550	Ref.U1	110.00 k	110.00	100.00m	✓
H5	153.00 PF	0.4100 %	ABB	Gob550	Ref.U2	110.00 k	110.00	100.00m	✓
H6	153.00 PF	0.4100 %	ABB	Gob550	Ref.U3	110.00 k	110.00	100.00m	✓

U | C | φ | tan δ Measurement

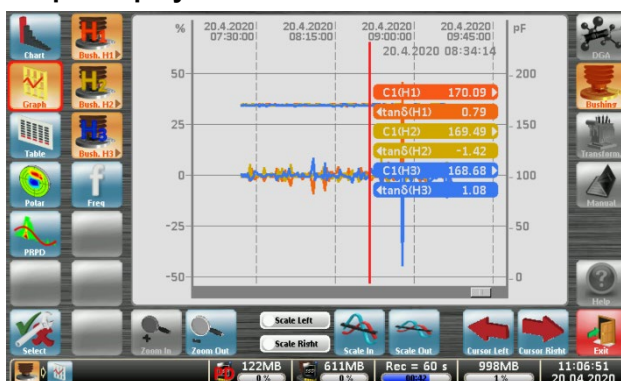
U _{H1} : 2.45840 V	Φ _{H1H2} : 120.456 °
U _{H2} : 2.42981 V	Φ _{H2H3} : 121.056 °
U _{H3} : 2.44297 V	Φ _{H3H1} : 118.488 °
U _{X1} : 2.45840 V	Φ _{X1X2} : 120.456 °
U _{X2} : 2.42981 V	Φ _{X2X3} : 121.056 °
U _{X3} : 2.44297 V	Φ _{X3X1} : 118.488 °
U ₁ : 57.7493 V	Φ _{U1H1} : -0.638 °
U ₂ : 57.6209 V	Φ _{U2H2} : -0.186 °
U ₃ : 57.6976 V	Φ _{U3H3} : 0.773 °
U ₁₂ : 99.9142 V	Φ _{U1X1} : -0.638 °
U ₂₃ : 99.8965 V	Φ _{U2X2} : -0.186 °
U ₃₁ : 99.9469 V	Φ _{U3X3} : 0.773 °

10 s f: 49.9965 Hz

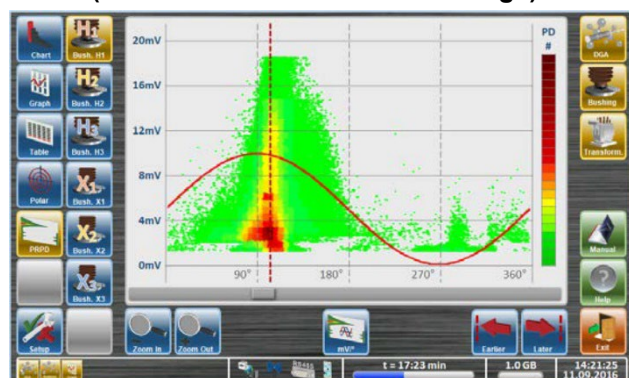
Chart Display



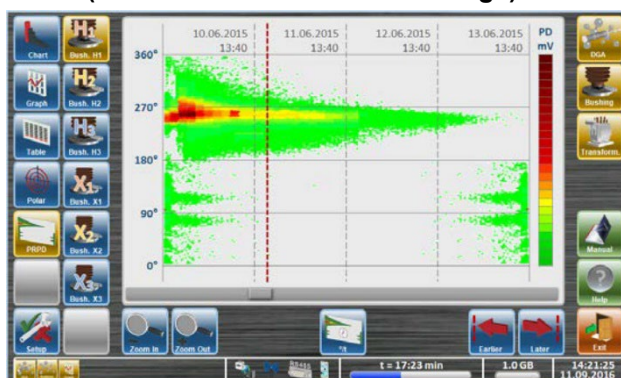
Graph Display



PRPD (Phase Resolved Partial Discharge)



TRPD (Time Resolved Partial Discharge)



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	

Safety	CE
Insulation protection:	EN 61010-1:II
Electrical protection class:	EN 61140: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			
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 (UF)

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

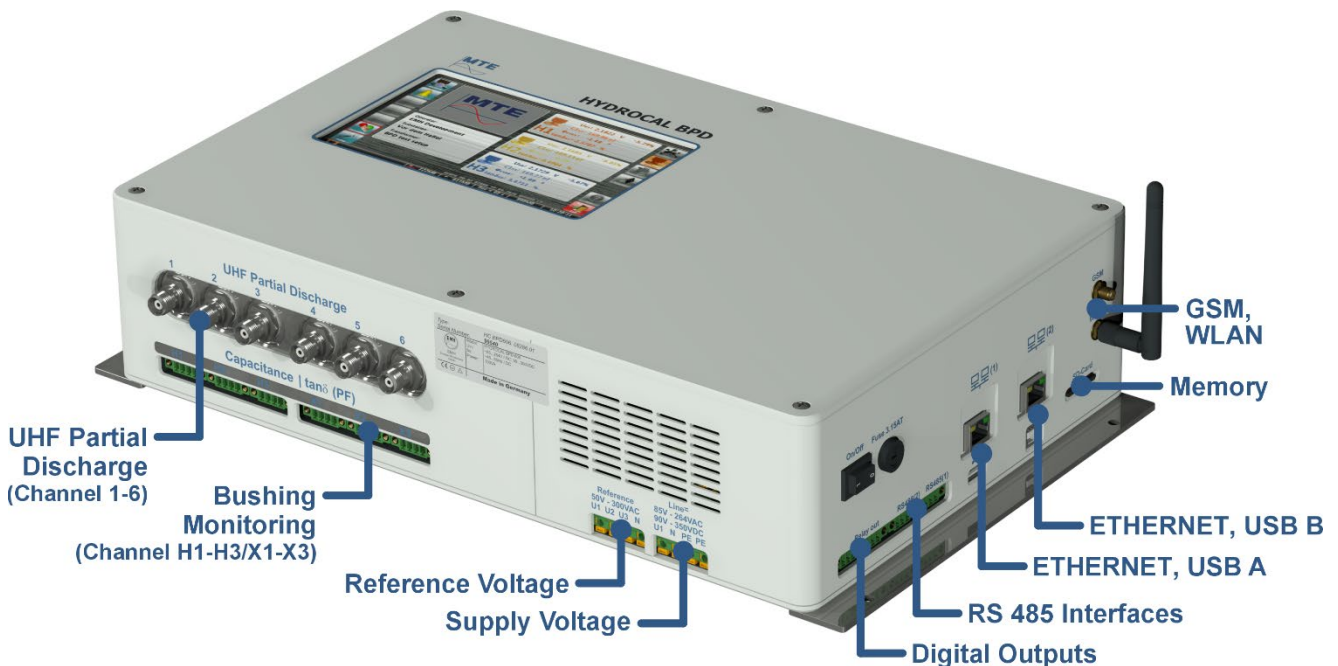
Communication

- 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 fiber-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 fiber-optical / SC Duplex (proprietary or MODBUS® TCP protocol and PRP)
- 4G modem with external adhesive antenna
- DNP3 protocol
- IEC 61850 protocol

Connections



MTE Meter Test Equipment

Subject to alterations



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