ENSURING THE FLOW.

Data Sheet

truesinus® digital technology

Picture of full-version system PHG TD/PD

VLF Cable Test and Diagnostic System PHG TD/PD

PHG – test system
TD – dissipation factor measurement
PD – partial discharge level measurement with source localisation

PHG - the expandable VLF cable test and diagnostic system

With the PHG TD / PD a multifunctional cable test and diagnostic system is available that has been specially designed and developed for medium voltage networks.
The PHG TD/PD system is the only cable test and diagnostic system with which a comprehensive complete overview on the quality and ageing of the test sample is obtained.
The TD and PD diagnostic methods complement each other ideally; on the one hand, the general condition of the sample can be determined, and on the other hand, individual faults are located.

The system unifies:

- VLF truesinus® cable testing (PHG 70 or PHG 80)
- TD dissipation factor measurement, tan delta (PHG TD)
- PD partial discharge level measurement and source localisation (PHG TD/PD)

System upgrade to PHG TD/PD

The test system consists of a control unit, power unit, discharge unit, safety controller and 25 m connection cable.

The system can be upgraded at any time with TD dissipation factor measurement and PD partial discharge measurement and localisation. The control unit is replaced by a PC.

Dissipation factor measurement (tan delta)

The VLF truesinus® dissipation factor measurement is the most reliable diagnostic method for determining the general condition of a cable section.

Partial discharge level measurement (PD)

Using this diagnostic method, PD level measurement as well as the localisation of partial discharge sources can be performed.

VLF cable testing

The test using VLF truesinus® on plastic insulated medium voltage cable systems has gained acceptance over the last few years and is rightly displacing the rather uninformative and damaging DC test (VDE 0276 and HD 620 S1).

The PHG (Programmable High voltage Generator) is a VLF truesinus® voltage source of the latest generation. The PHG system meets all requirements in respect of safety, robustness, ease of use, automation, documentation and can be applied universally, e.g. for

- Cable testing
- Sheath testing
- Generator testing
- Transformer testing
- Testing of switchgears

Contrary to other types of test voltage, truesinus® is defined, symmetrical, continuous and independent from the test sample.For DC testing of mass impregnated paper cables, the truesinus® test voltage is suitable as well. For compound networks the powerful PHG 80 is available as optimum test system. For high voltage DC testing, e.g. for mass impregnated cables the PHG 80 offers stabilised output voltage from 1 up to 80 kV.
Using the self explanatory menu guiding, individual testing procedures can be defined and stored. High voltage breakdowns during the test are automatically detected and a switch off or programmable fault burning procedure is initiated.

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Professional software for the engineer

PHG features

- Powerful VLF truesinus® test generator (3 kW) with adjusted output voltage
- Compact, enclosed 19” design
- Variable installation due to separated control unit and power unit
- Variable possibilities of connection to cable stations of different design
- Manual or automatic test sequence, selectably with or without burn down mode in case of breakdown
- Prepared for installation in test van
- Self explanatory menu guiding
- Built-in printer for the output of test report
- Safety control according to VDE 0104
- Programmable test voltage: truesinus®, squarewave, DC
- Fully symmetric output voltage
- Programmable frequency 0.01Hz … 1Hz

User-friendly menu guiding easy operation

The PHG test generator includes user-friendly, self-explanatory software. The menu text is available in several languages, e.g., German, English, French and Spanish. After starting the test is performed fully automatically in accordance with the selected test sequence.

VLF cable diagnostics with the dissipation factor measuring system PHG TD

Diagnostics using dissipation factor measurement with VLF truesinus® voltage provides differentiated information on the ageing of PE/XLPE cables. A differentiation is made between new, slightly and heavily water-tree damaged cables. In this way the urgency of cable replacement can be determined. The combination of the programmable test generator PHG 70 or PHG 80 with the BAUR dissipation factor measurement system results in the cable test and diagnostic system PHG TD. The system is operated via the PC controller. In the menu Dissipation Factor Measurement, diagnostic sequences can be programmed.
The dissipation factor values are measured at different voltage levels and then they are evaluated.

All important cable data can be stored, so that step-by-step a cable database is created which enables an evaluation of the diagnostic results on the basis of the historical evolution of a cable system.

In the TD main menu all essential data are summarised: Additionally to the information on the actual voltage, the phase under diagnostics and the actual capacitive load, the actually measured values of current and voltage, the actual dissipation factor value and the dissipation factor mean value are displayed. As supplementary information, measuring value fluctuations are determined and displayed. Base for this determination is the standard deviation of the values on a certain voltage level. The leakage current display in µA serves as a check of the range of parasitic currents (e.g. over the surface of cable terminations) which are excluded from the dissipation factor measurement.

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The most important advantages

- menu guided control surface (MS Windows)
- automatic diagnostic sequences according to individual programming
- possibility of the definition of breaking off criteria in case of exceeding limitation values
- control of parasitic currents
- numeric and graphics display of the measured dissipation factor values as a function of the voltage
- high reliability for assessment on water tree aged cables with low residual rigidity
- large dynamic range of the measurement parameters
- intensity to interference
- very little time required to assess a medium voltage cable (3-phase cable approx. 1 hour)
- diagnostic parameters are independent from cable length
- no limitation due to the length of the connection cable, therefore suitable for problematic connection situation (e.g. pole stations)
- option: measuring range extension for small loads to a minimum of 500 pF possible

VLF partial discharge level measurement and localisation with the measuring system PHG TD/PD

Diagnostics on PE / XLPE and paper insulated mass impregnated cables

The VLF test and ageing diagnostics at PE / XLPE cables by means of dissipation factor measurement are the criteria, on which the assessment of energy cables can be based. The partial discharge measurement with localisation of the partial discharge source closes the gap in the insulation diagnostics of PILC and assures the assessment of plastic cables.

With the withstand test a pure „go/no go“ statement about the actual expanded dielectric strength of the weakest point within a cable system is made. It is carried out after laying, after repairs or at service aged cables to prove the operational safety.

Diagnostics via VLF dissipation factor measurement delivers information about the global ageing condition of plastic cables.

The partial discharge measuring method provides reliable information on whether there are installation errors or electrical trees on plastic cables that have not yet caused a breakdown.

It can be estimated whether a dissipation factor measurement was possibly influenced by intensive partial discharges (for example in joints).

Using partial discharge measurement with source localisation, direct allocation of partial discharge activity on cable segments, joints or cable terminations is enabled. The person responsible is thus in the position to be able to take preventive measures and thus avoid local faults in the plant.

Beneath cable assessment partial discharge level measurements for the insulation diagnostics of other samples is also possible.
The partial discharge level measurement can be implemented into the PHG TD system which then forms the cable test and diagnostic system PHG TD/PD. All important cable data can be stored in the program, so that step-by-step
a cable database is created which enables to make the operational evaluation of the diagnostic results on the basis of the historical evolution of a cable system.

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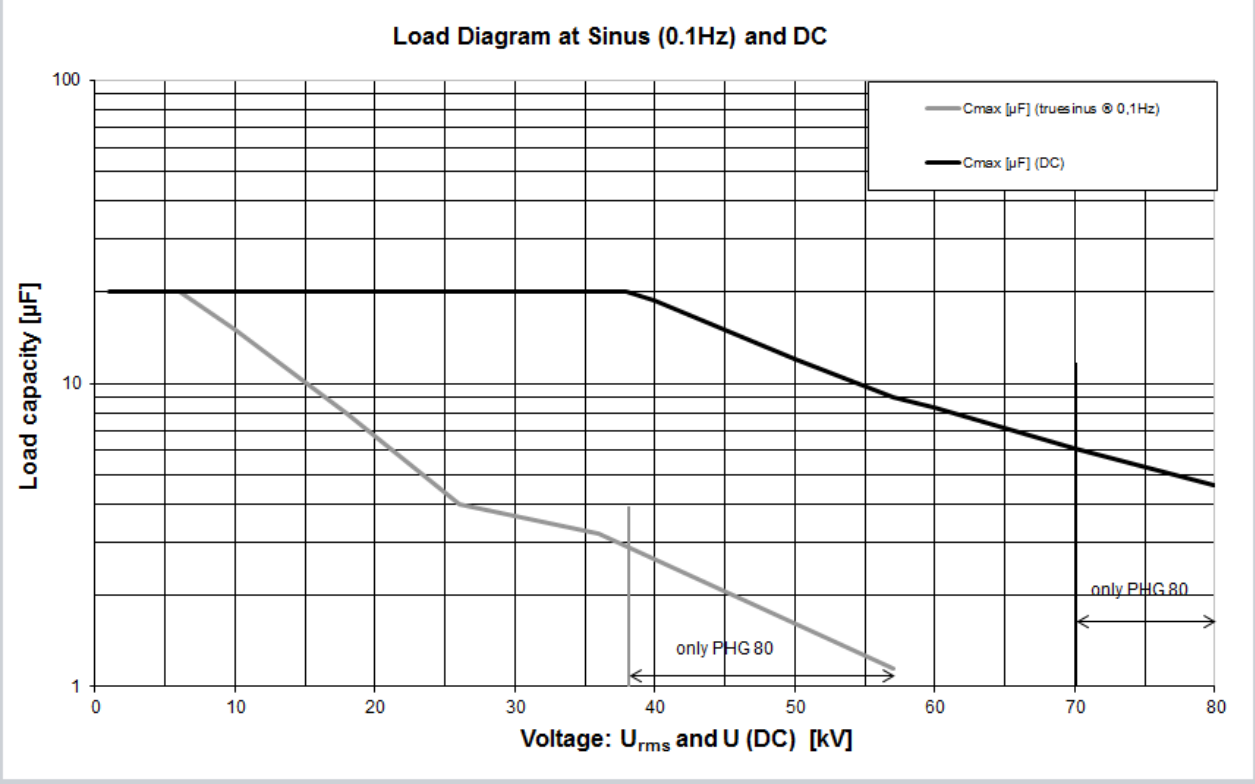
Essential characteristics of the partial discharge localisation system

- High resolution
- High noise suppression
- Menu guided control surface (MS Windows)
- PD level measurement and PD source localisation
- Display of PD activity over the cable length
- Convenient connecting technique
- Automatic measurement of fault positions

Technical Data

Test System	**PHG 70**	**PHG 80**
Power supply	230 V (50/60 Hz), (200...264 V)	230 V (50/60 Hz), (200...264 V)
	115 V (50/60 Hz), (100...140 V)	115 V (50/60 Hz), (100...140 V)
Output voltage	38 kVrms truesinus®	57 kVrms truesinus®
	squarewave: 57 kV/0.1 Hz	squarewave: 80 kV/0.1 Hz
	DC: +/- 70 kV	DC: +/- 80 kV
	Accuracy	1 %
	Resolution	0,1 kV
Output current	DC current	
	70 kV, 10 mA	80 kV, 1.8 mA
	50 kV, 60 mA	50 kV, 60 mA
	20 kV, 90 mA	20 kV, 90 mA
	Measuring range	0 ... 120 mA
	Accuracy	1 %
	Resolution	10 µA



Test System

Selectable test frequency	0.01 Hz ... 1 Hz
Serial interface	RS 232, with fibre optic link
Relative humidity	not condensing
Max. ambient temperature	working: 0°C ...+45°C
	storage: -20°C...+60°C
Display	for menu, output voltage, current; illuminated 160 x 80 dot matrix, LCD
Selectable languages	English, German, French, Spanish, other languages on request
Power unit	
Dimensions	19“,14 U (483 x 623 x 775 mm)
Weight	approx. 160 kg
Weight of complete PHG system	depending on version 250 – 400 kg

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Dissipation factor measurement TD

Voltage range	1-38 kVrms truesinus® (PHG 70) 1-57 kVrms truesinus® (PHG 80)
Load range	≥ 10 nF (≥ 500 pF, option)
Measuring range	$0{,}1x10^{-3}$ … $1000x10^{-3}$
Resolution	$1x10^{-5}$
Accuracy	± 1 % measuring value $\pm 1x10^{-4}$
Industrial PC	BAUR IPC, Pentium, MS Windows
Display	15.1“TFT

Partial discharge level measurement with source localisation PD

Test System	**PHG 70 and PHG 80**	
Voltage range	1-38 kVrms truesinus®	(PHG 70 TD PD)
	1-57 kVrms truesinus®	(PHG 80 TD PD)
Measuring range	12 800 m (at 80m/µs)	
Propagation rate	50 … 120 m/µs	
Sample rate	10 ns (100 Mega Samples)	
PD background noise level	20 pC	
Accuracy of localisation	1 % of the cable length	
Resolution	0.1 pC; 0.1 m	
Industrial PC	BAUR IPC, Pentium, MS Windows	
Display	15.1“TFT	

PHG 70
Delivery includes: 411+030

- High voltage generator PHG 70
- Operating unit of test generator PHG (19" version / 5 U)
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
  Length of connection cables 25m / 50 m
- Protection ground terminal
- Set of G-clamps, Corona-hood
- Earthing stick
- 19 " - rack 1 x 25 U and 1 x 8 U
- Cleaning cloth saturated with isopropanol (package with 50 pcs)
- User Manual

Options:

- Coupling unit CC1 PHG for cable fault location with IRG
- External Emergency-Off unit with signal lamps; cable length 25 m
- External Emergency-Off unit with signal lamps; cable length 50 m
- Discharge rod; 12 kWs; 80 kV max.
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm

PHG 70 TD

Delivery includes: 411+032

- High voltage generator PHG 70
- TD – system upgrade PHG
- Inudstrial PC without monitor (19 “ version / 4 U)
- Monitor TFT 15,1“ (version 19 " / 6 U with connection cables)
- PC keyboard with trackball 19 “ - drawer 1 U PS/2 Windows
- Software MS Windows XP ML on CDR (6 pcs.)
- Virusscan McAffee ML
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
  Length of connection cables 25m / 50 m
- Protection ground terminal, monitored for KTG M
- Set of G-clamps, Corona-hood
- HV connection set TD PHG (VSE box)
- Earthing stick
- 19 “ - rack 1 x 25 U and 1 x 8 U
- User Manual

Options:

- Software PC-Replay TD PHG 70, PHG 80
- Ink-jet printer colour printing
- USB line for connection of printer to PC
- Monitor TFT 15.1" (foldable, in drawer 19" / 2 U) with connection cables
- Reference capacitor 15 kVrms / 60 nF for TD measuring
- Reference capacitor 25 kV eff / 40 nF for TD measuring
- Reference capacitor 57 kV eff / 300 nF for TD measuring
- TD measuring range extension for short cable lengths with calibration
- Coupling unit CC1 PHG for cable fault location with IRG
- External Emergency-Off unit with signal lamps; cable length 25 m
- External Emergency-Off unit with signal lamps; cable length 50 m
- Discharge rod; 12 kWs; 80 kV max.
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm

PHG 70 TD / PD
Delivery includes: 411+034

- High voltage generator PHG 70
- TD/PD – system upgrade PHG
- Inudstrial PC without monitor (19 “ version / 4 U)
- Monitor TFT 15,1“ (version 19 " / 6 U with connection cables)
- PC keyboard with trackball 19 “ - drawer 1 U PS/2 Windows
- Software MS Windows XP ML on CDR (6 pcs.)
- Virusscan McAffee ML
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
  Length of connection cables 25m / 50 m
- Protection ground terminal, monitored for KTG M
- Set of G-clamps, Corona-hood
- HV connection set TD PHG (VSE box)
- PD system upgrade high voltage coupling PHG (filter and coupling capacitor)
- Earthing stick
- 19 “ - rack 1 x 25 U and 1 x 8 U
- User Manual

Options:

- Software PC-Replay TD / PD PHG 70, PHG 80
- Ink-jet printer colour printing
- USB line for connection of printer to PC
- Monitor TFT 15.1" (foldable, in drawer 19" / 2 U) with connection cables
- Reference capacitor 15 kVrms / 60 nF for TD measuring
- Reference capacitor 25 kV eff / 40 nF for TD measuring
- Reference capacitor 57 kV eff / 300 nF for TD measuring
- TD measuring range extension for short cable lengths with calibration
- Coupling unit CC1 PHG for cable fault location with IRG
- External Emergency-Off unit with signal lamps; cable length 25 m
- External Emergency-Off unit with signal lamps; cable length 50 m
- Discharge rod; 12 kWs; 80 kV max.
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm

PHG 80
Delivery includes: 411+031

- High voltage generator PHG 80
- Operating unit of test generator PHG (19" version / 5 U)
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
- Length of connection cables 25m / 50 m
- Protection ground terminal, monitored for KTG M
- Set of G-clamps, Corona-hood
- Earthing stick
- 19 “ - rack 1 x 25 U and 1 x 8 U
- User Manual

Options:

- Coupling unit CC1 PHG for cable fault location with IRG
- External Emergency-Off unit with signal lamps; cable length 25 m
- External Emergency-Off unit with signal lamps; cable length 50 m
- Discharge rod; 12 kWs; 80 kV max.
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm

PHG 80 TD
Delivery includes: 411+033

- High voltage generator PHG 80
- TD - system upgrade PHG
- Inudstrial PC without monitor (19 “ version / 4 U)
- Monitor TFT 15,1“ (version 19 " / 6 U with connection cables)
- PC keyboard with trackball 19 “ - drawer 1 U PS/2 Windows
- Software MS Windows XP ML on CDR (6 pcs.)
- Virusscan McAffee ML
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
  Length of connection cables 25m / 50 m
- Protection ground terminal, monitored for KTG M
- Set of G-clamps, Corona-hood
- HV connection set TD PHG (VSE box)
- Earthing stick
- 19 “ - rack 1 x 25 U and 1 x 8 U
- User Manual
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm

Options:

- Software PC-Replay TD PHG 70, PHG 80
- Ink-jet printer colour printing
- USB line for connection of printer to PC
- Monitor TFT 15.1" (foldable, in drawer 19" / 2 U) with connection cables
- Reference capacitor 15 kVrms / 60 nF for TD measuring
- Reference capacitor 25 kV eff / 40 nF for TD measuring
- Reference capacitor 57 kV eff / 300 nF for TD measuring
- TD measuring range extension for short cable lengths with calibration
- Coupling unit CC1 PHG for cable fault location with IRG
- External Emergency-Off unit with signal lamps; cable length 25 m
- External Emergency-Off unit with signal lamps; cable length 50 m
- Discharge rod; 12 kWs**; 80 kV max.**

PHG 80 TD / PD
Delivery includes: 411+035

- High voltage generator PHG 70
- TD / PD - system upgrade PHG
- Inudstrial PC without monitor (19 “ version / 4 U)
- Monitor TFT 15,1“ (version 19 " / 6 U with connection cables)
- PC keyboard with trackball 19 “ - drawer 1 U PS/2 Windows
- Software MS Windows XP ML on CDR (6 pcs.)
- Virusscan McAffee ML
- Safety control unit SCU (19" Version / 2 U)
- Discharge unit DU with HV sockets (19" version / 8 U)
- Cable drum rack KTG M3 with connection cables
  Length of connection cables 25m / 50 m
- Protection ground terminal, monitored for KTG M
- Set of G-clamps, Corona-hood
- HV connection set TD PHG (VSE box)
- PD system upgrade high voltage coupling PHG (filter and coupling capacitor)
- Earthing stick
- 19 “ - rack 1 x 25 U and 1 x 8 U
- User Manual

Options:

- Software PC-Replay TD / PD PHG 70, PHG 80
- Ink-jet printer colour printing
- USB line for connection of printer to PC
- Monitor TFT 15.1" (foldable, in drawer 19" / 2 U) with connection cables
- Reference capacitor 15 kVrms / 60 nF for TD measuring
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- Discharge rod; 12 kWs; 80 kV max.
- Drawer 19" / 3 U; 650 mm depth; module depth 700 mm