

The NEW high power test and diagnosis combination for MV cables



Patented
Technology

TDM 45 Series

- Cable testing, cable diagnosis and sheath testing in one device
- Enables standard compliant high power VLF testing at 0.1 Hz ($5 \mu\text{F} @ 40 \text{ kV}_{\text{rms}}$)
- Internal tanDelta measurement with automatic result interpretation
- Partial discharge diagnosis using VLF Sine wave, Damped AC or 50/60 Hz Slope technology voltages

Megger[®]

Time-saving and effective way of evaluating new and in-service power cables

The new TDM 45 series is a revolutionary breakthrough in testing and diagnosis of MV cables. The patented concept addresses the increasing utilities need in flexibility in use of test and measuring equipment based on the type of application.

The modular concept allows the engineer to individually set-up the unit based on the type of job that needs to be executed. If e.g. withstand testing on short cable lengths need to be performed then only one module is needed. When part of the task is also to perform a partial discharge diagnosis then an additional module is needed.

The concept

Depending on your needs either one, two, or a maximum number of three modules are needed:

- **Base module:** VLF Sinus 45 kV for standard compliant withstand testing of short cables and dielectric loss measurements.
- **Boost module:** VLF Booster 40 kV for standard compliant withstand testing of long cables up to 20 km length at maximum test voltage and 0.1 Hz test frequency.
- **Partial discharge module:** PDS 60 for partial discharge (PD) diagnosis, can either be used with the base module only, or also in conjunction with the boost module to perform PD measurements at Damped AC voltages or 50/60 Hz Slope.



TDM 45 Base module



TDM 4540 Base and Boost module



PDS 60 PD module

Key facts and features

The TDM 45 series combines the following features and functionalities in one single test system:

Testing

- High testable capacity of 5 μF @ 0.1 Hz and 40 kVrms up to 10 μF at lower test voltage levels
- AC/DC testing in compliance with DIN VDE, EN, IEEE and with up to three different voltage waveforms
- DC voltage test with positive and negative polarities up to 45 kV
- Sheath testing and sheath fault pinpointing with up to 20 kV negative DC voltage acc. to IEC 60229
- Continuous duty cycle (testing without operational interruptions)
- Manual and automatic frequency adjustment
- Leakage current measurement in DC voltage, rectangular voltage and cosine rectangular voltage test modes
- Breakdown detection with automatic disconnection of test voltage and discharging of the test object if the charging current is too high
- Maximum user safety through automatic discharge of the test object and earth loop ground monitoring
- Intuitive user software with large internal memory
- Quick, easy logging into Easyprot software and firmware updates via USB interface

tanDelta Diagnosis

- Optional full-fledged, internal tanDelta step test with automatic result interpretation acc. to IEEE 400.2
- Meaningful Voltage Withstand Diagnosis (VLF test and tanDelta diagnosis in one step)

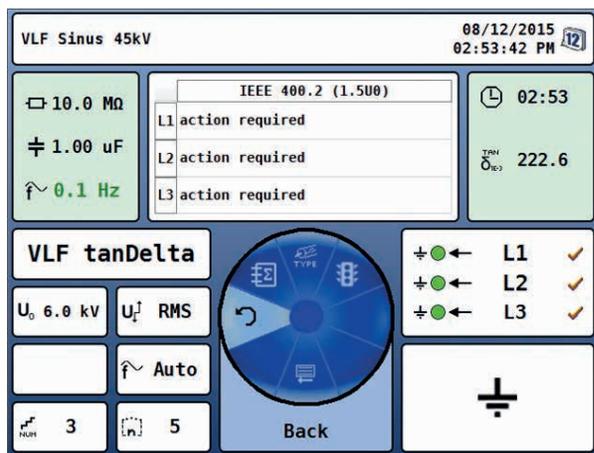
Partial discharge diagnosis:

- Powerful database: Simplified searching, browsing and administration of measurement and cable data.
- Fully automatic calibration with the option of calibrating according to cable length or if cable length unknown by propagation velocity.
- Clear display of measurement results and live PD localization. A time-consuming post-processing of the measured data is no longer necessary.
- Phase Resolved Partial Discharge (PRPD) pattern display
- Monitored withstand testing in VLF Sine Wave, VLF CR and DAC mode
- Report generation by mouse click.

Individually set-up with modular concept

Base module: VLF Sinus 45 kV

The base module is the most versatile one, with help from this base unit the user can perform VLF withstand testing as per IEC or IEEE standard, DC testing, sheath testing as per IEC 60229 and sheath fault pin-pointing in conjunction with the optional step voltage probe ESG NT or any other.



User interface VLF Sinus 45 kV

Moreover, the optional internal tanDelta expands the system to assess both cable integrity and condition and that without the need of an external computer. Automatic result interpretation based on the IEEE 400.2 guideline directly visually displays the condition of the cable and gives a recommendation after the complete measurement has ended.

Equipped with intuitively operating software and a large internal memory, the VLF Sinus 45 kV stores all data automatically. Via the USB port, datasets can be easily exported and processed for report generation via the PC software Easyprot (incl. in delivery). The user can review all performed measurements either immediately or at a later point in time (internally). The well thought-out operating principle combined with simple visual commands guide the user through the entire measurement process, keeping the training time at the minimum even for advanced cable diagnosis.

The smart VLF system automatically adjusts the test frequency to the cable length, making even tests on 25 kV rated cables (up to 25 km) easy and reliable. Earth loop monitoring and automatic discharge eliminate hazards to the user. The automatic discharge functionality makes the use of an external safety stick no longer necessary. In the event of excessive charge current, the integrated breakdown detection shuts down the test voltage, preventing extensive damage to the cable.



TDM 45-P / TDM 45-P-TD

Boost module: VLF Booster 40 kV

Are the cables too long to perform standard compliant testing at 0.1 Hz, no problem; the Boost module expands the Base unit to a high power VLF test set. Long cables up to 20km length can easily be tested at the standardized frequency of 0.1 Hz. This patented concept is unique, and one of its kind.

The integrated cable compartment with connection cables simplifies the connection to the base unit, no more looking around for cables, and no faulty connections possible. Once connected to the base unit, this unit will automatically recognize that the Boost unit is connected and the high power test set is ready for operation. Operation, control, display of results and reporting will all be via the user interface of the base unit.

Not only testing of long cables becomes possible with the Boost unit in addition this unit can, in conjunction with the PD module, also be used for partial discharge measurements with proven Damped AC voltages or with the 50 Hz Slope Technology.



TDM 4540-P / TDM 4540-P-TD: Top part is base module, bottom part is boost module with integrated cable compartment.

Your partner with long-lasting experience in partial discharge diagnosis

Partial discharge module: PDS 60

Network operators can now get faster and significantly more reliable information about the quality and the condition of their cables. This is made possible thanks to the brand-new PD module PDS 60. For the first time, it has become possible to immediately locate faults in underground cables during the actual PD measurement.

The PD module can either be used with the Base unit only, in this case only PD measurements with VLF Sinusoidal voltages are possible, or with our recommended version, with the Base and Boost module. Using in addition the Boost module allows PD testing at frequencies comparable to the operating frequencies, which is an utmost for reliable decision making.

The PD module PDS 60 has been developed based on many years of field experience, customer demands and innovations. For the first time it has become possible to perform so called "monitored withstand testing". During the VLF withstand test partial discharges can be monitored to get a clear picture about the quality of workmanship, it is not needed to do this separately anymore saving valuable outage time and costs.

Depending on the PDS 60 module selected it can be used for Sine wave PD testing, for the 50Hz Slope and DAC PD testing, or for all three voltage wave shapes. In all cases the user will benefit from the internal database of the PD detector software, of the live PD mapping and of the reporting function by mouse-click. Based on our and other experiences it is recommended to do PD measurements at test frequencies comparable to the power frequency. This is possible when using the proven Damped AC (DAC) and 50Hz Slope technology generated by the combination of the base unit and boost unit only.

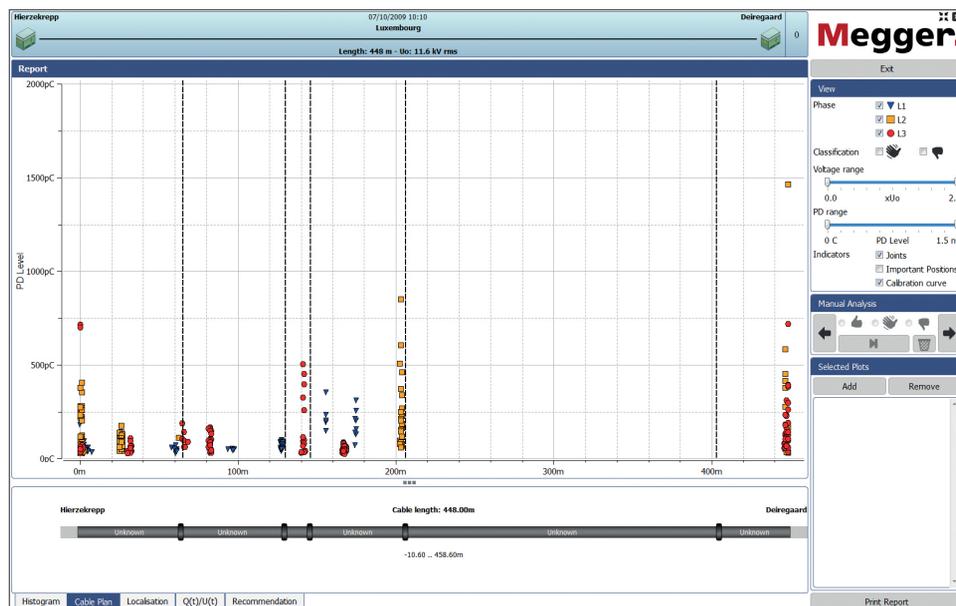


TDM 4540-P-TD-PD: Full fledged recommended version for cable testing, dielectric loss measurement and partial discharge diagnosis.

The focus of the new technology is on the user

The operating software is designed so that any user will come to grips with it immediately:

- Integrated database, simplified searching, browsing and administration of measurement and cable data.
- Improved fully automatic calibration with display of signal to noise ratio.
- “Live” PD mapping: The PD evaluation algorithm enables a reliable automatic detection and precise location of partial discharges (PD mapping) whilst the measurement is taking place. Time-consuming post-processing of the measurement data is no longer needed, maintenance resources can be directly scheduled.
- Reporting by mouse click: immediately after the measurement has been completed, the operator can create a report with a clearly structured summary of the most important measurement data with a simple mouse click. Parallel it is also possible to generate customized reports which can be saved as templates.



User friendly control and evaluation software of the PDS 60.

System overview

Select your systems based on your needs! All systems can be upgraded in a later time span without the need of shipping the unit back!	TDM 45-P	TDM 45-P-TD	TDM 45-P-PD *	TDM 45-P-TD-PD *	TDM 4540-P	TDM 4540-P-TD	TDM 4540-P-PD	TDM 4540-P-TD-PD
	VLF Testing of short cable lengths	✓	✓	✓	✓	✓	✓	✓
VLF Testing of long cable lengths	✗	✗	✗	✗	✓	✓	✓	✓
TanDelta diagnosis	✗	✓	✗	✓	✗	✓	✗	✓
Partial discharge diagnosis	✗	✗	✓	✓	✗	✗	✓	✓
	Set 1	Set 2	Set 3	Set 4				

* PD testing with VLF Sinusoidal voltages only

Set 1:
TDM 45-P / TDM 45-P-TD



Set 2:
TDM 45-P-PD / TDM 45-P-TD-PD



Set 3:
TDM 4540-P / TDM 4540-P-TD



Set 4:
TDM 4540-P-PD / TDM 4540-P-TD-PD



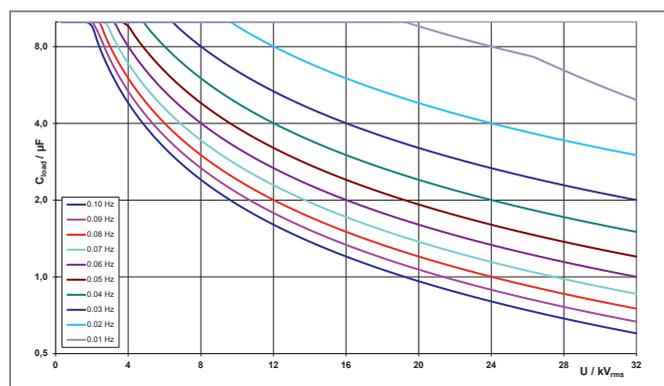
Base module VLF Sinus 45 kV

Technical data

Output voltage	
VLF sine wave	0 ... 32 kVRMS / 0 ... 45 kVpeak
DC voltage	± 0 ... 45 kV
VLF rectangular voltage	± 0 ... 45 kV
Precision	± 1%
Resolution	0.1 kV
Output current	
Measuring range	0 ... 20 mA
Precision	± 2%
Resolution	10 µA
Frequency range	0.01 Hz ... 0.1 Hz
Output load	0.6 µF @ 0.1 Hz @ 32 kVRMS; 10 µF maximum test capacity
Internal tanDelta	
Measuring range	10 ⁻³ ... 10 ⁰
Precision	10 ⁻³ bzw. 1%
Resolution	10 ⁻⁴
Sheath testing (as per IEC 60229)	0 ... 5 kV, 0 ... 10 kV, 0 ... 20 kV DC
Sheath fault pin-pointing	0 ... 5 kV, 0 ... 10 kV, 0 ... 20 kV DC (Pulse rate 0,5:1; 1:2; 1:3; 1:4; 1,5:0,5)
Safety	Earth loop ground monitoring, automatic discharging of the test object
Input voltage	110 V ... 230 V, 50/60 Hz, 600 VA
Duty cycle	Continuous
Internal memory	For at least 1000 Measurements
Dimensions (W x D x H)	544 x 416 x 520 mm
Weight	50 kg
Protection class	IP 21
Operating temperature	-20°C ... + 55°C
Storage temperature	-20°C ... + 70 °C

Scope of delivery

- VLF Sinus 45 kV
- HV Connection cable 5m
- Mains/ ground cable 5m
- Accessory bag
- USB Stick for logging with Easyprot SW



Load diagramm VLF Sinus 45 kV

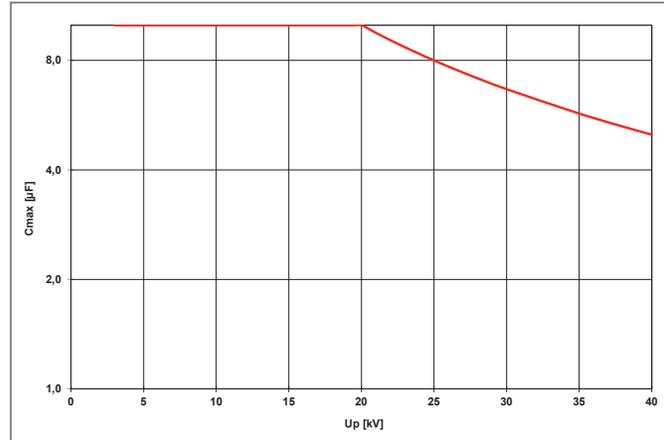
Boost module VLF CR-40-TB

Technical data

Output voltage		
VLF CR		0 ... 40 kV _{RMS}
	Precision	± 1%
	Resolution	0.1 kV
Leakage current		
Measuring range		0 ... 20 mA
	Precision	± 30 µA; ± 2% of test value
	Resolution	10 µA
Frequency		0.1 Hz
Output		5 µF @ 0.1 Hz @ 40 kVRMS; 10 µF maximum test capacity
Duty cycle		Continuous
Safety		F-Ω Earth loop monitoring; automatic discharging of test object
Dimensions (W x D x H)		544 x 416 x 424 mm
Weight		42 kg
Protection class		IP 21
Operating temperature		-20 ... +55°C
Storage temperature		-40 ... +70°C

Scope of delivery

- VLF CR-40-TB with integrated cable compartment and cables



Load diagram VLF CR-40-TB

Partial discharge module PDS 60

Technical data

PD module PDS 60		
Voltage	Operation Type	0 ... 60 kV _{RMS} VLF Sinusoidal, VLF Cosine rectangular or Damped AC
Capacity of HV coupling capacitor		25 nF
Sensitivity range		2 pC ... 100 nC
Resolution		± 1 pC
PD self-noise level		< 2 pC
PD impulse repetition rate		100 kHz
PD localization	Measuring range Propagation velocity v/2 Sampling rate Bandwidth Precision Resolution	0 ... 16.000 m / v/2= 80 m/μs 5 ... 120 m/μs 125 MHz (8 ns) 3 / 25 MHz (switchable) 1% of the cable length ±0.1 pC / ±0.1 m
Filter		Analog and digital
Power supply		24 V via TDM base module
Temperature	Operation Storage	-20 °C ... +55 °C -40 °C ... +70 °C
Relative humidity		93 % / 30 °C (non-condensing)
Weight	HV filter/ coupler PD detector	25 kg 6 kg
Dimensions (W x D x H)		544 x 416 x 424 mm
PD calibrator (IEC 60270-compliant)	Measuring range Power supply	200 pC ... 20 nC 9 V block battery
Software		EasyGo principle, integrated cable database, fully automatic evaluation

Scope of delivery

- PDS 60
- Laptop + Laptop bag
- SW + SW license incl. 3 hardware keys
- Set of LV cables PDS 60 5m
- HV connection cable 1.5m
- PD Calibrator
- Accessory bag

Ordering information

Product (sets)	Order no.
TDM 45-P	1007572
TDM 45-P-TD	1007581
TDM 45-P-PD	1007579
TDM 45-P-TD-PD	1007580
TDM 4540-P	1007573
TDM 4540-P-TD	1007578
TDM 4540-P-PD	1007574
TDM 4540-P-TD-PD	1007577
Product (individual components)	Order no.
VLF Sinus 45 kV	128300045-S
VLF Booster 40 kV	128311042
Internal tanDelta	138316309
Internal tanDelta (retroactive)	138316310
PDS 60 for Sine wave PD	1007582
PDS 60 for VLF CR and DAC PD	1003380
PD Calibrator (200 pC – 20 nC)	90007366
Optional HV connection cables	Order no.
VLF Sinus 45 HV connection cable 5 m	118306900
VLF Sinus 45 HV connection cable 10 m	2004420
VLF Sinus 45 HV connection cable 15 m	2004421
PDS 60 HV connection cable PD free 1.5 m	138316094
PDS 60 HV connection cable PD free 3 m	2005655
PDS 60 HV connection cable PD free 5 m	890010915
PDS 60 HV connection cable PD free 10 m	890023555
PDS 60 HV connection cable PD free 15 m	890015603
Optional accessories	Order no.
Additional SW licence (1 Dongle)	90011938
Mounting bracket PDS 60	2003886
Diagnostic connection set	890017909
PD-free test adapter PD PA-MC-12	820016301
PD-free test adapter PD PA-MC-16	820016302
VLF 3 phase connection set bus-bar	128311801
VLF 3 phase connection set SF6 switchgear M12	128311799
VLF 3 phase connection set SF6 switchgear M16	128311800
ESG NT step voltage probe	1004629-S