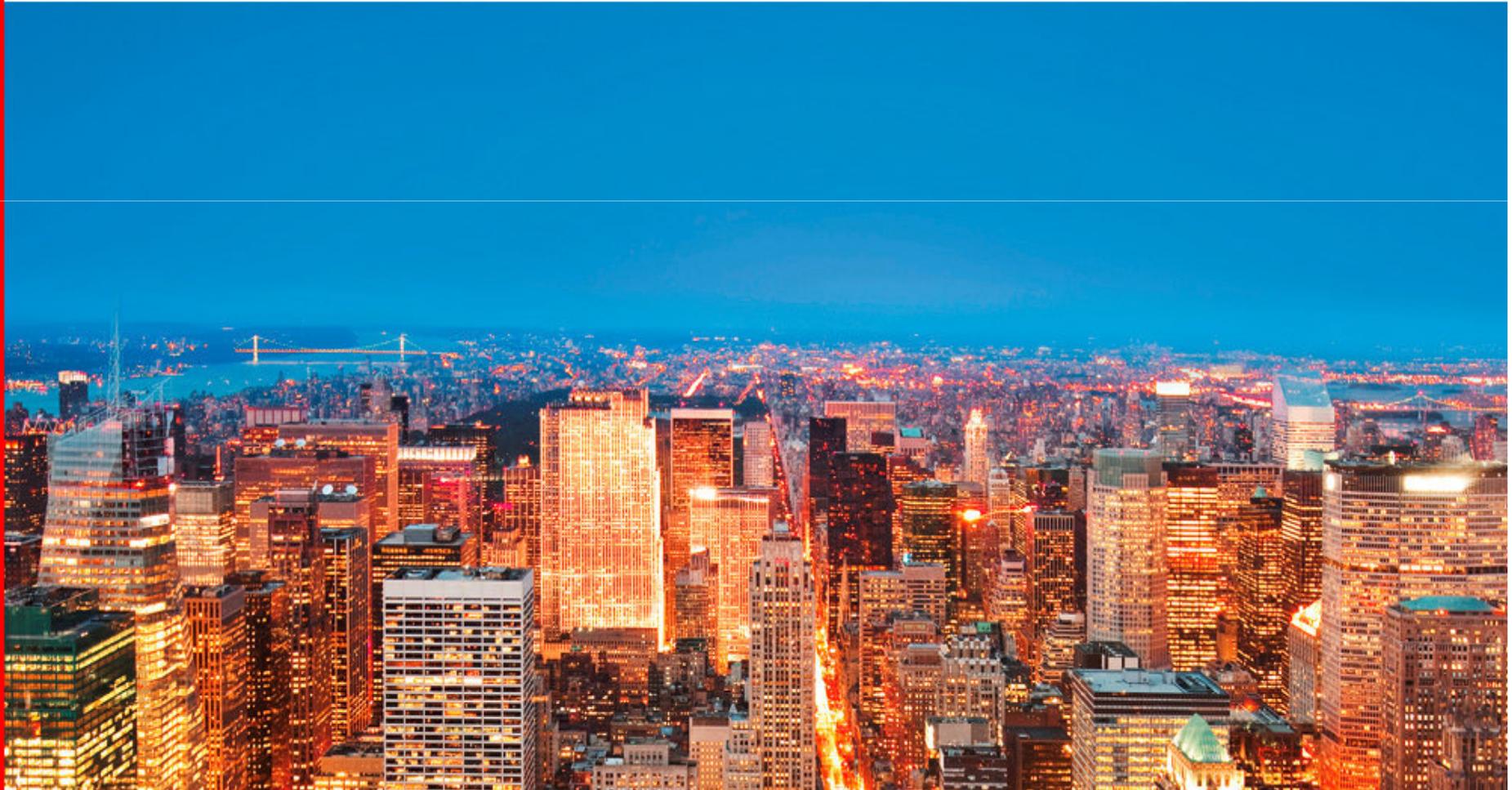


XIV. Szigetelésdiagnosztikai Konferencia
Bambara Hotel – Felsőtárkány (Hungary)

sebaKMT
A member of Megger Group

The New TDS NT Series

Test & Diagnostic system in one device





Power Networks



Communication Networks



Water Networks



TV Inspection of Sewers



Line and Object Location

The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

Operating Software

Summary

The NEW HV DAC Series

The NEW TDS NT Series – Part I

Sidestep I – VLF CR

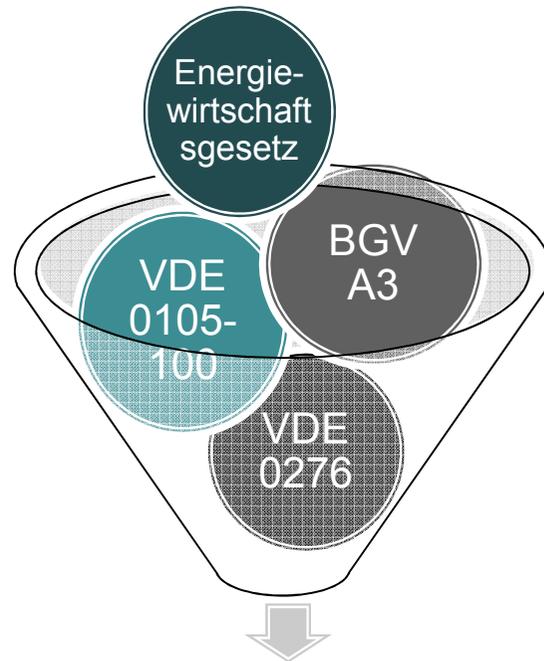
The NEW TDS NT Series – Part II

Operating Software

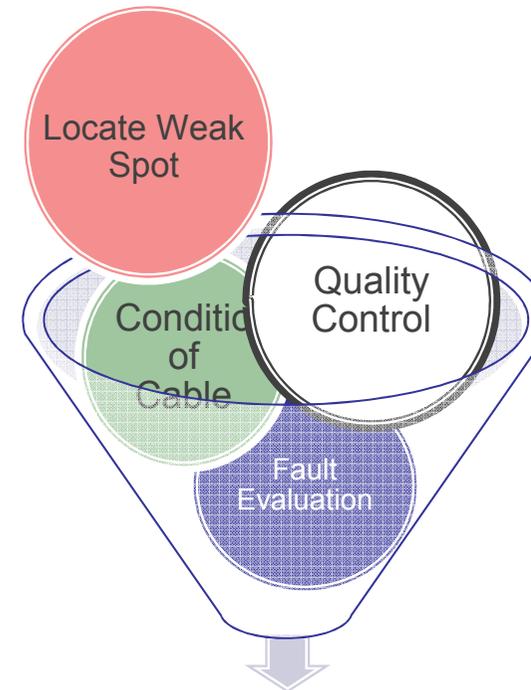
Summary

The NEW HV DAC Series

Why performing Cable Testing & Cable Diagnosis?



Safety & Reliability
of the Cable Network



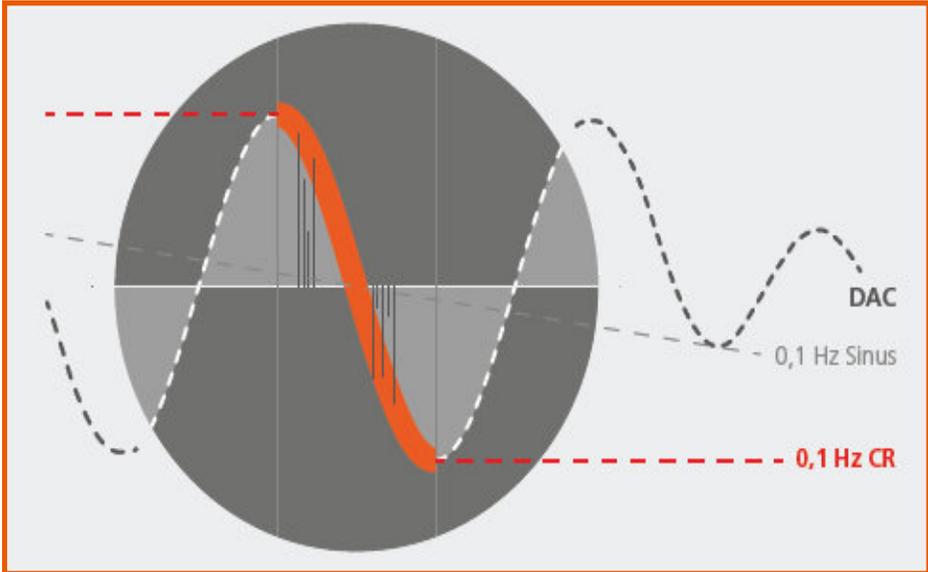
Assetmanagement
of the Cable System



Partial Discharge Diagnosis



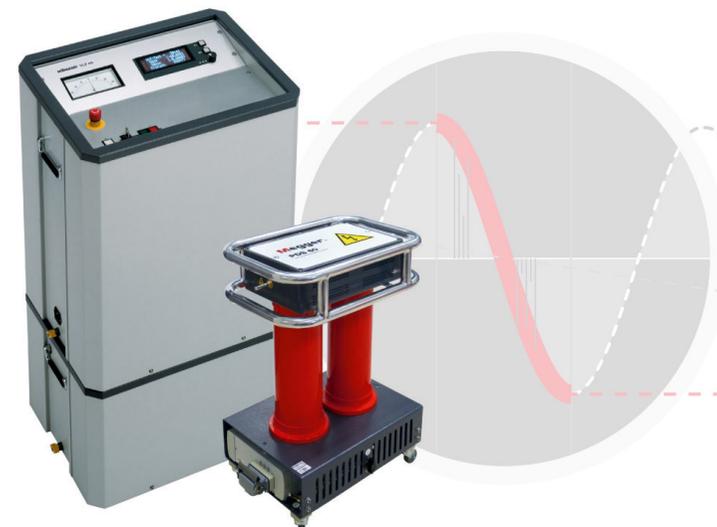
Cable Testing



- The *new TDS* series will be the *next generation of combining testing with diagnostics*

Customer will benefit from:

- ⊕ *Combined power source*
 - ➔ *DAC* wave shape for a well proven *non-destructive PD diagnosis*
 - ➔ *VLF CR* wave shape for *high power VLF monitored withstand testing* (could be *combined with PD*)
- ⊕ PD data which is fully *comparable with 50/60 Hz*, enabling *reliable decision making*
- ⊕ Latest state of the art PD user SW including “*on the fly*” *PD mapping* (automatic data evaluation during actual measurement)



Why using DAC PD?

- Damped AC voltage (DAC) has proven itself to be the correct method to *reliably identify partial discharges* using a *non-destructive voltage*

Customer benefits:

- ⊕ *Non-destructive* voltage wave shape
- ⊕ well proven method where PD data can be *compared with 50/60 Hz* (reliable decision making)
- ⊕ *Ideal for condition based maintenance on aged cable circuits*

Why using VLF CR PD?

Main advantage of having the VLF CR wave shape available

➡ Perform a **standard compliant VLF withstand test with accompanied PD Diagnosis**

Customer benefits:

⊕ **Saving time**

➡ If no PD has been determined during the test than no separate PD diagnosis is needed

⊕ Direct indication about the **quality of workmanship** during the withstand test

⊕ **PD data comparable to 50/60 Hz**

➡ which is important for the reliable decision making

⊕ **VLF testing at 0.1 Hz** (the only allowed frequency as per **IEC 60502-2**)

50 Hz Slope Technology

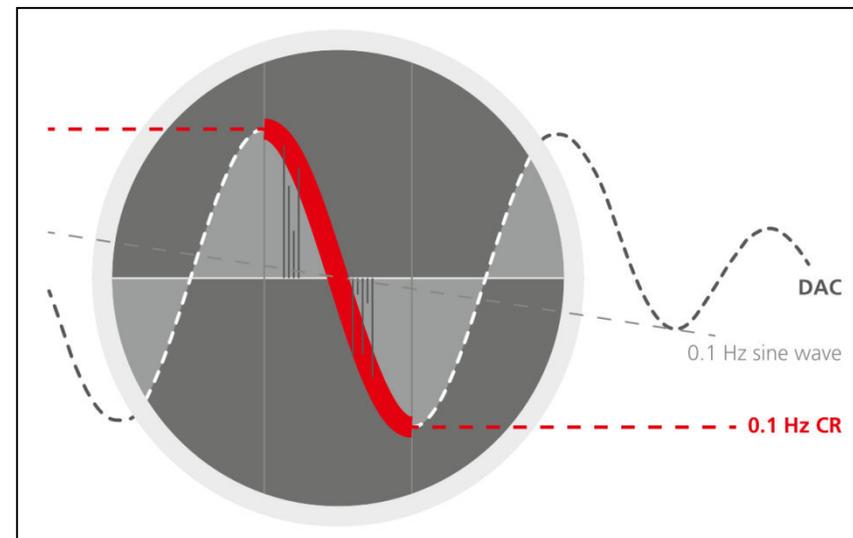
- Both **VLF CR** & **DAC** voltage wave shapes are having a frequency **comparable** to the **50/60 Hz** power frequency
 - ➔ Therefore wave shapes are **ideal for a PD diagnosis**
 - ➔ In contrast to VLF 0.1 Hz Sinusoidal voltages with a difference in frequency of 500/600 times

VLF CR

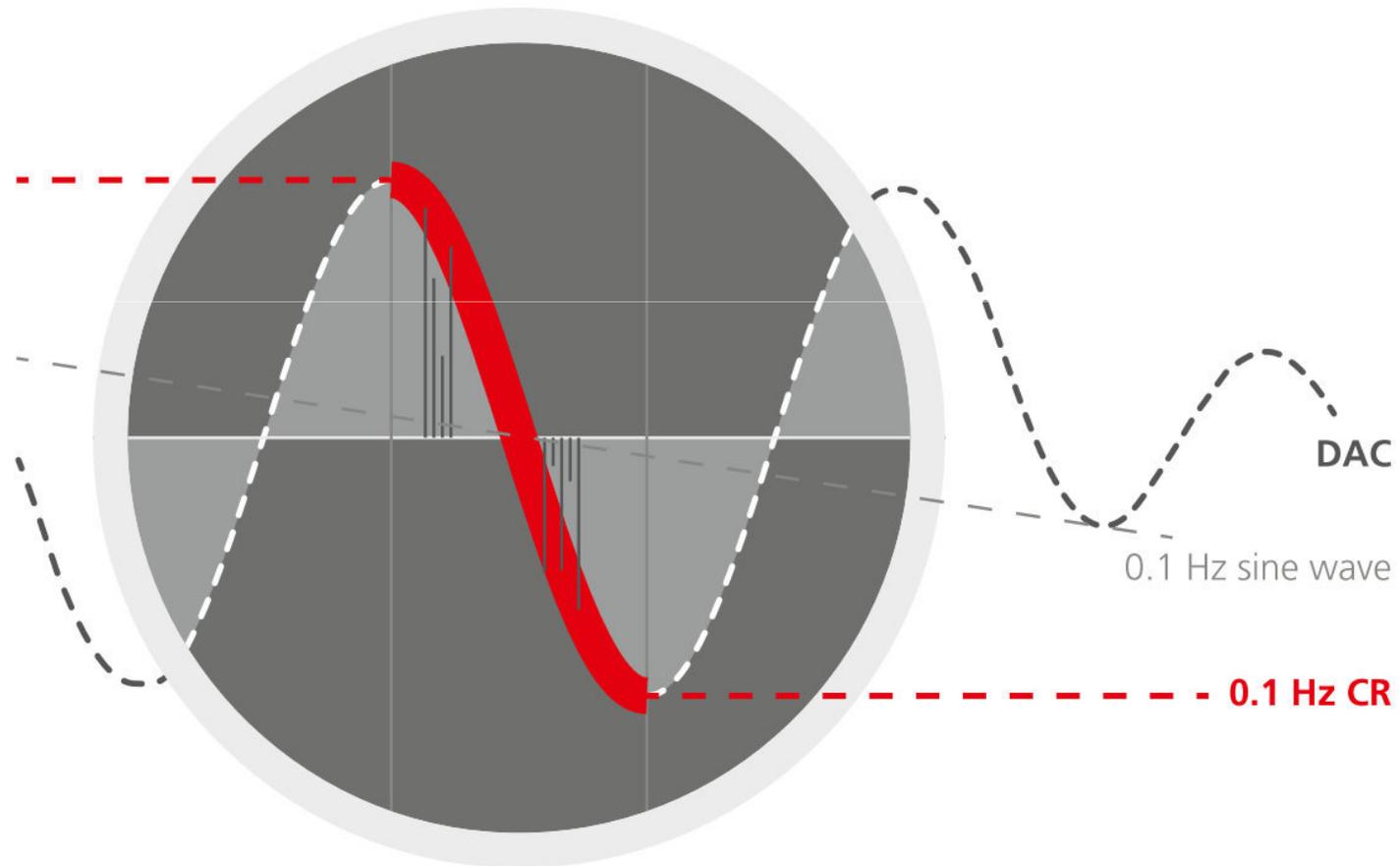
- ➔ PD measured during voltage transition

DAC

- ➔ PD measured during oscillating phase



50 Hz Slope Technology



The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

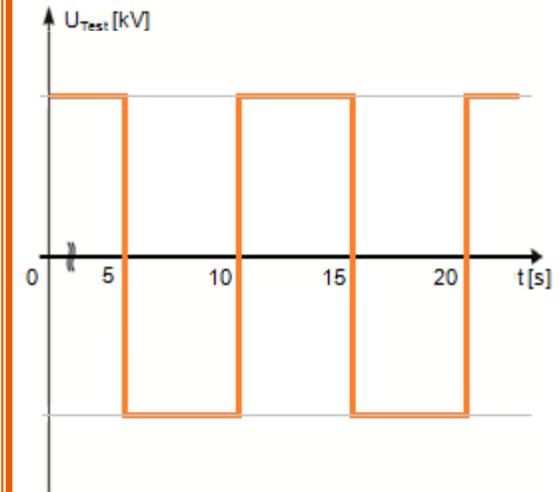
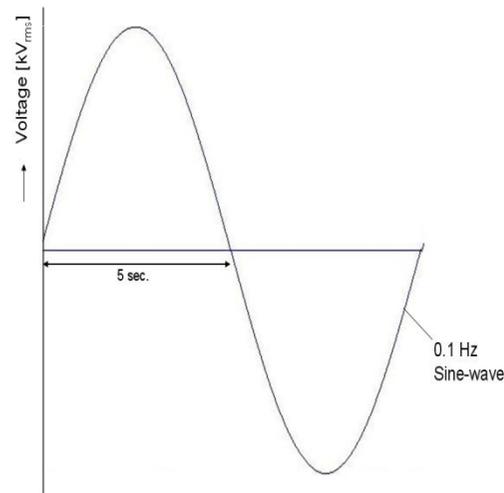
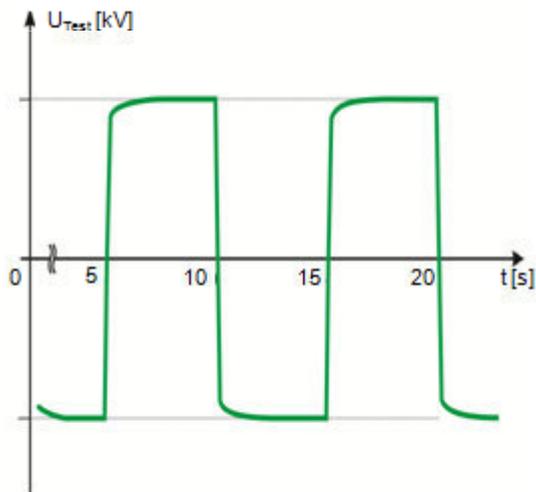
Operating Software

Summary

The NEW HV DAC Series

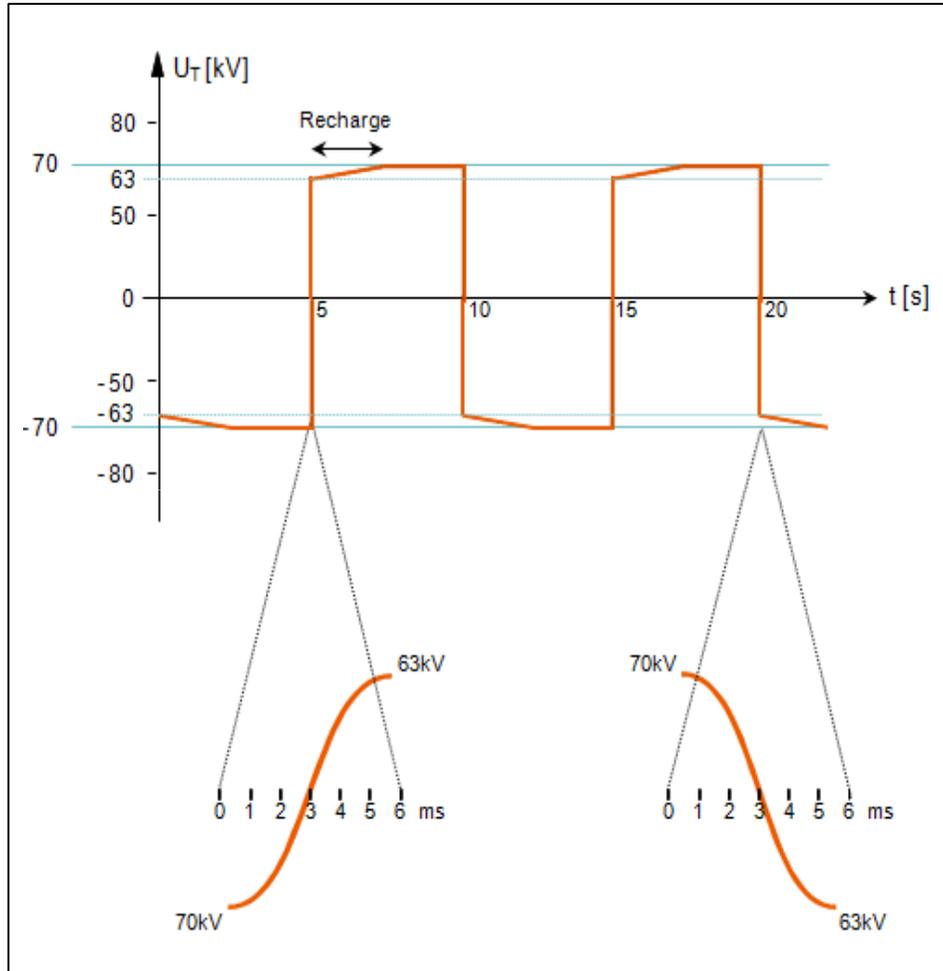
VLF Technologies

VLF Cosine-Rectangular



1) VLF Rectangular voltage under load has a trapezoidal wave shape & therefore peak value not equal to RMS value!

VLF Cosine Rectangular Wave Shape



- 1 Charging with negative polarity
- 2 Discharge of the voltage supply & waiting in negative polarity
- 3 Recharge to positive polarity. Depending on type with recharge
- 4 Waiting in positive polarity
- 5 Recharge to negative polarity

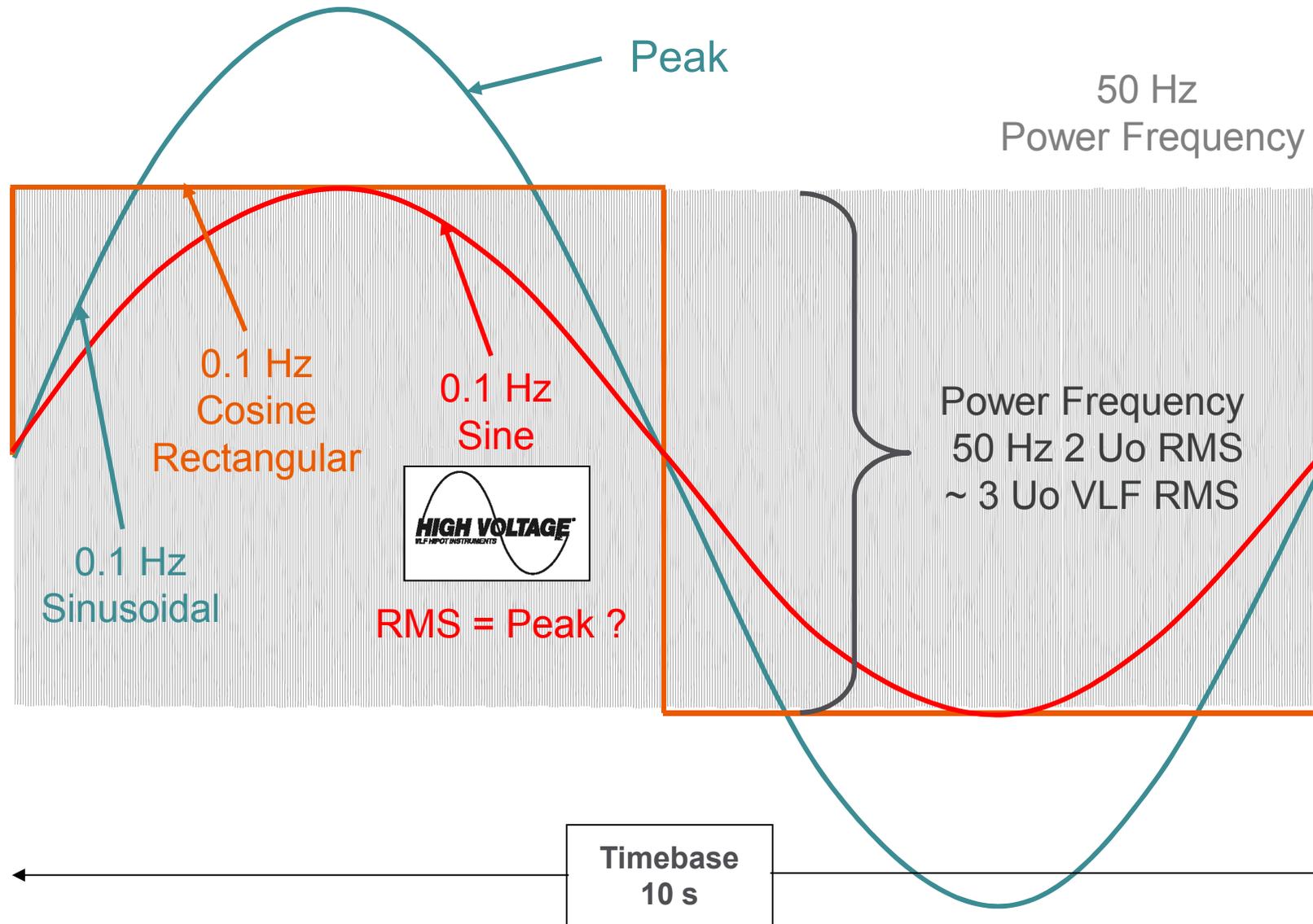
Voltage drop based on:

1. Losses due to resistive components in coil
2. Losses due to leakage in the cable

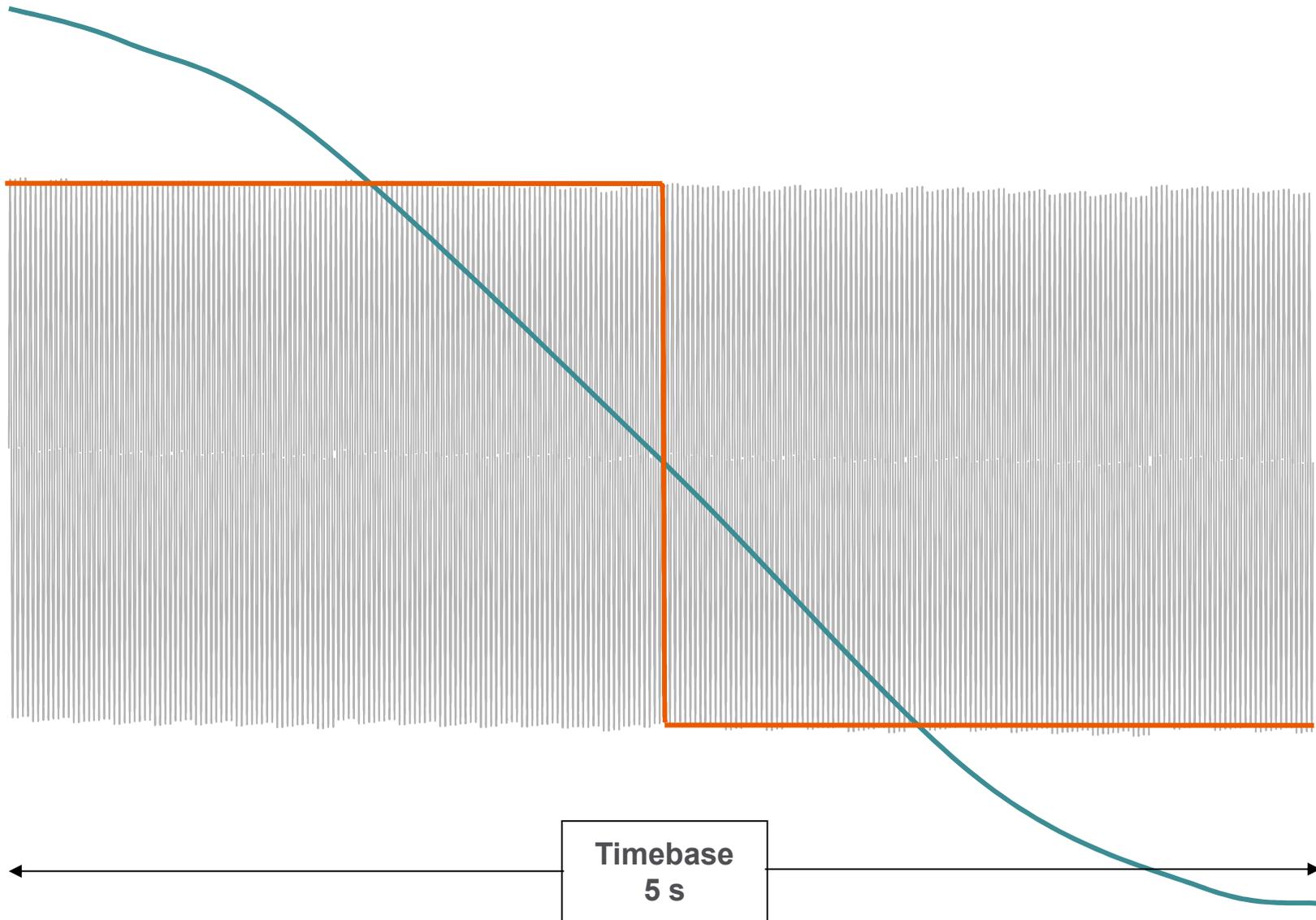
High losses are an indication for **poor cable** insulation



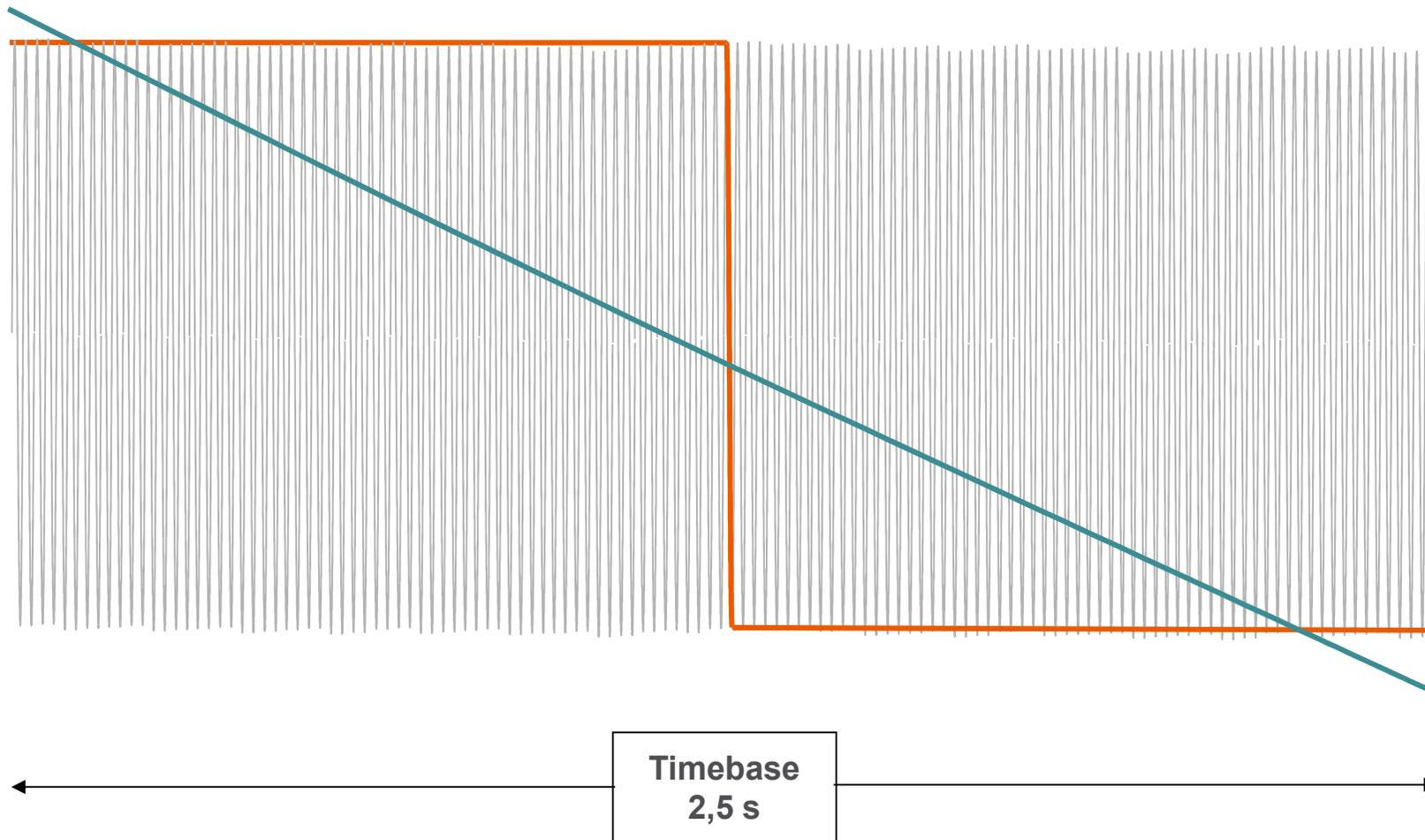
VLF 0.1 Hz Cosine Rectangular Wave Shape



VLF 0.1 Hz Cosine Rectangular Wave Shape

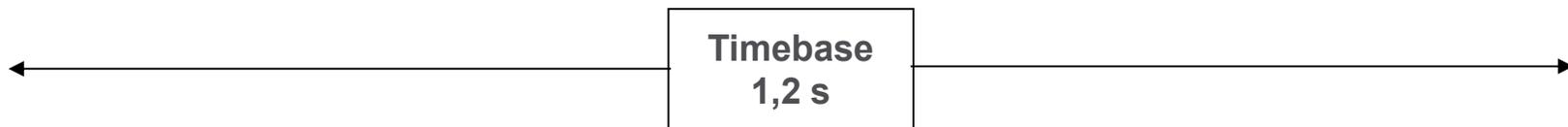
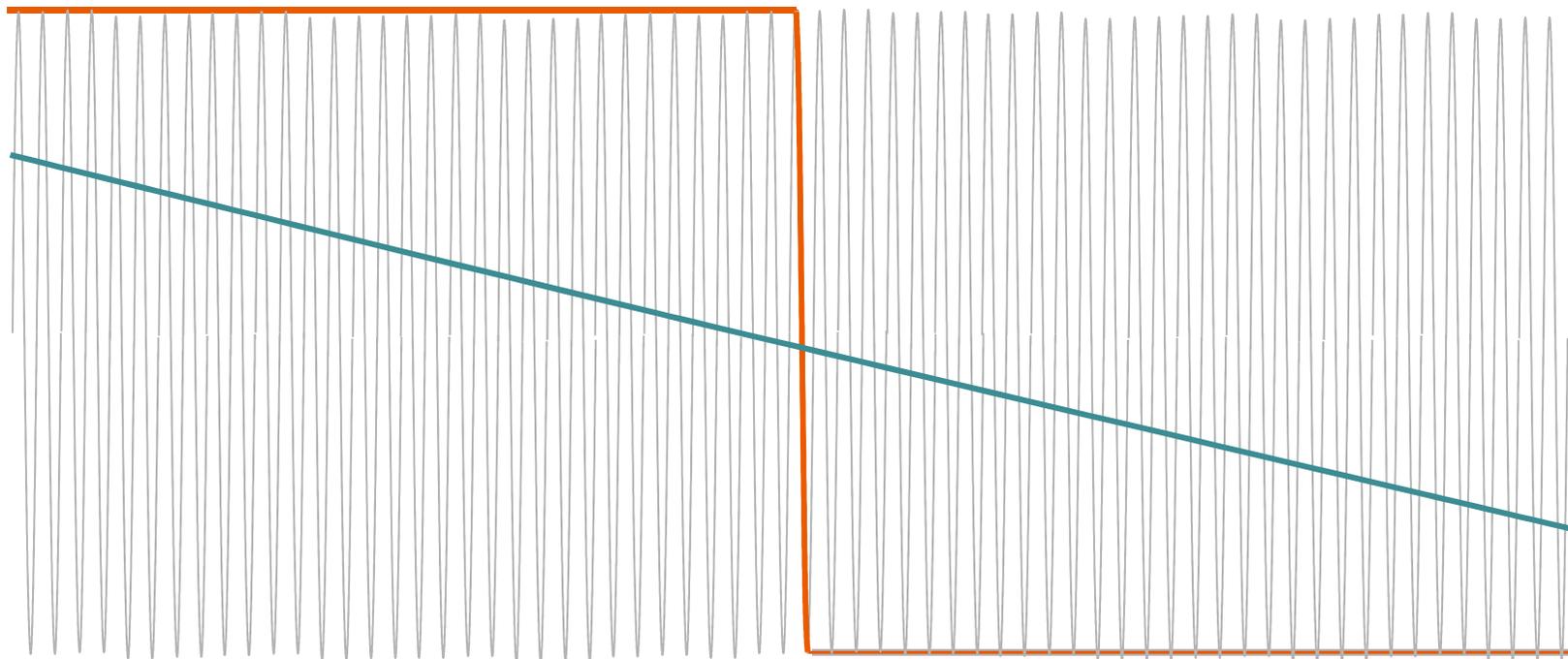


VLF 0.1 Hz Cosine Rectangular Wave Shape

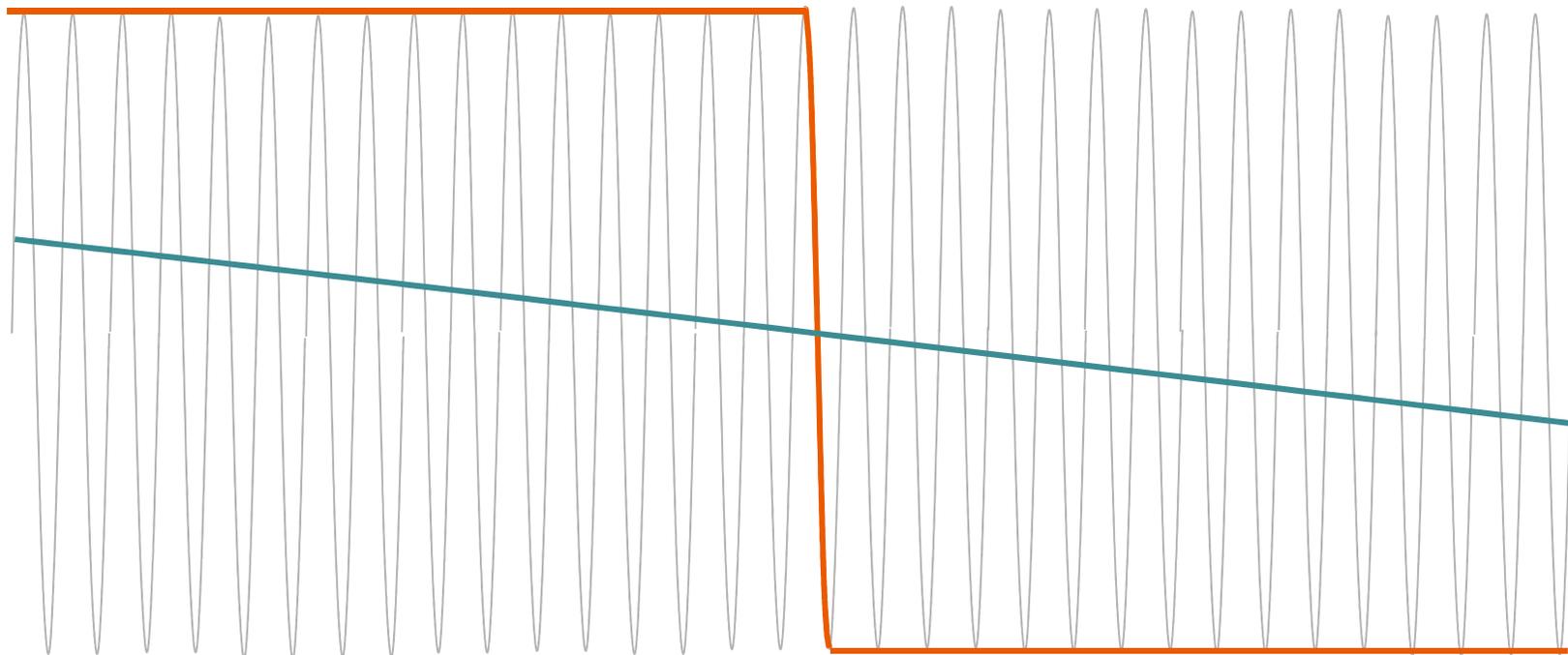


VLF 0.1 Hz Cosine Rectangular Wave Shape

≈ 60 Cycles

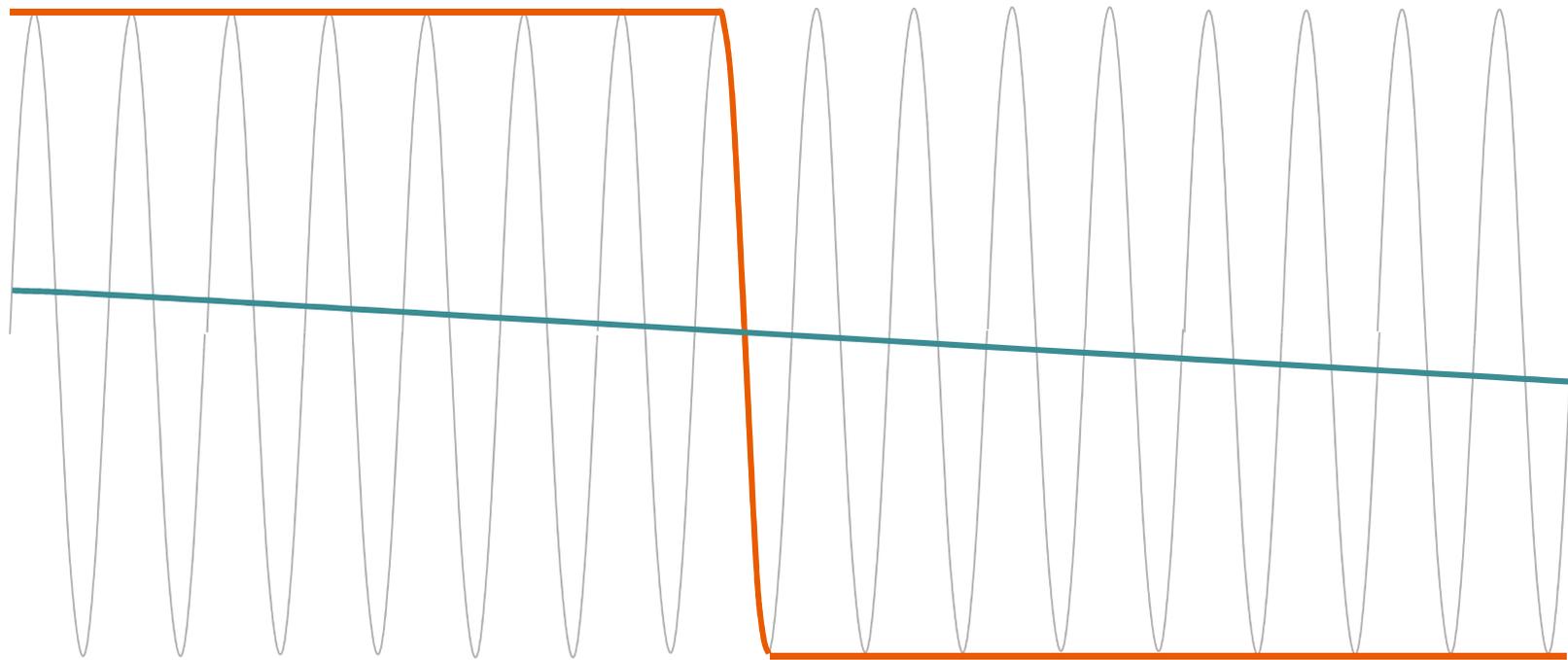


VLF 0.1 Hz Cosine Rectangular Wave Shape



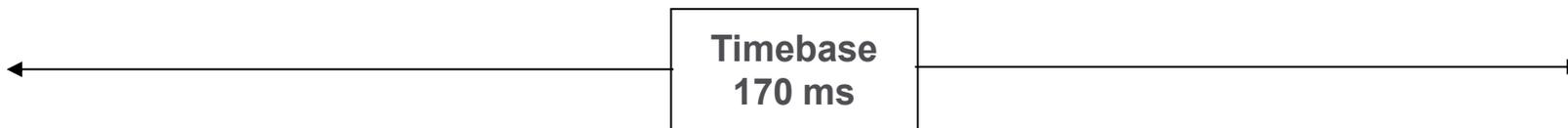
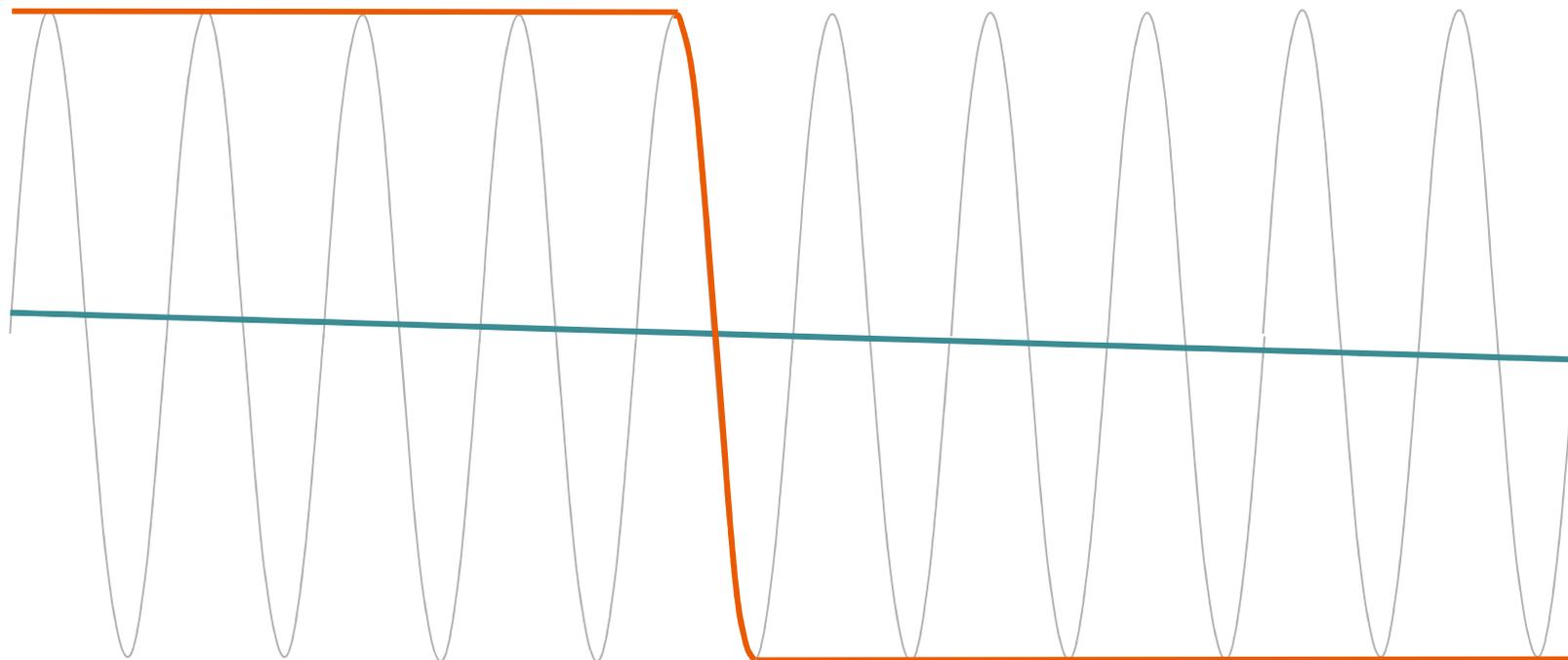
← Timebase 600 ms →

VLF 0.1 Hz Cosine Rectangular Wave Shape

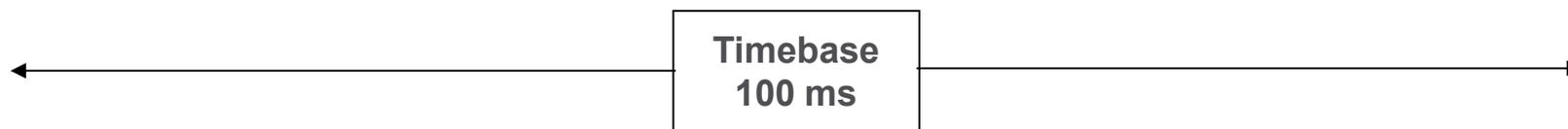
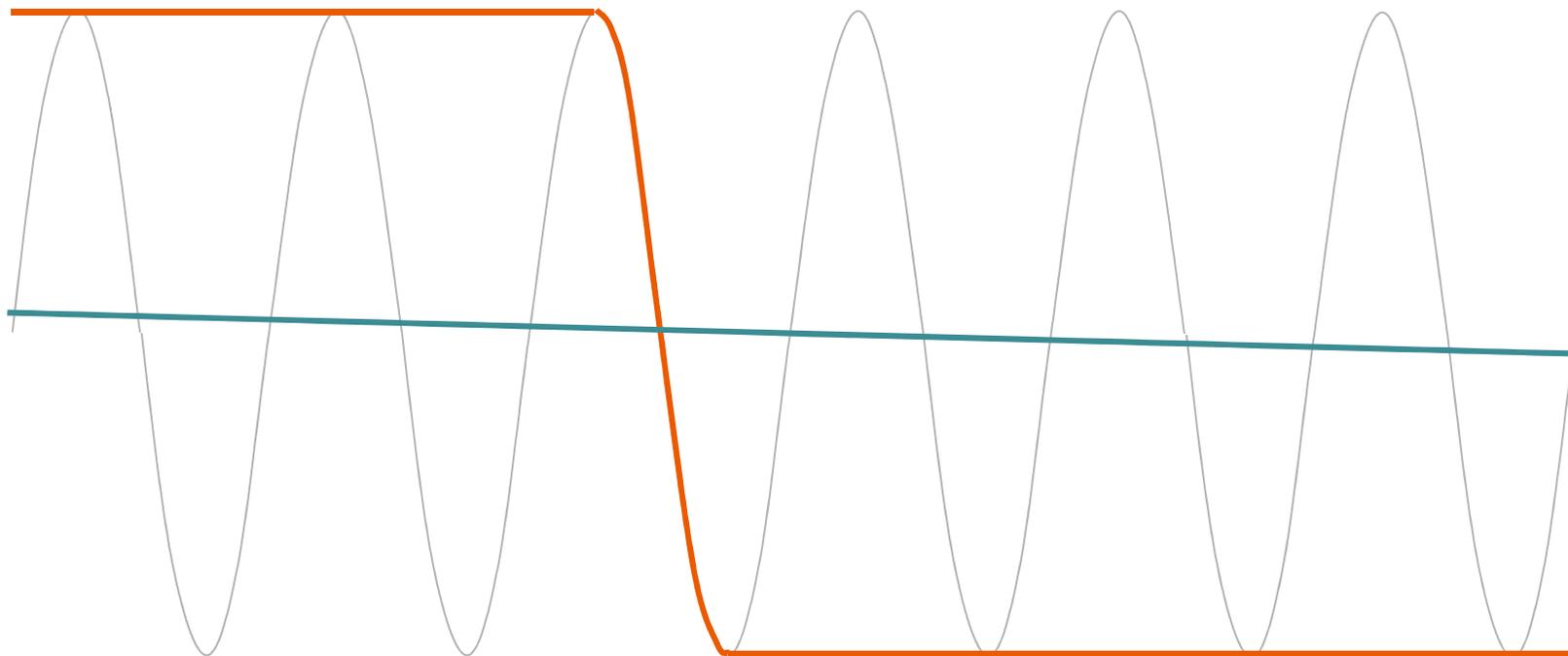


← Timebase 300 ms →

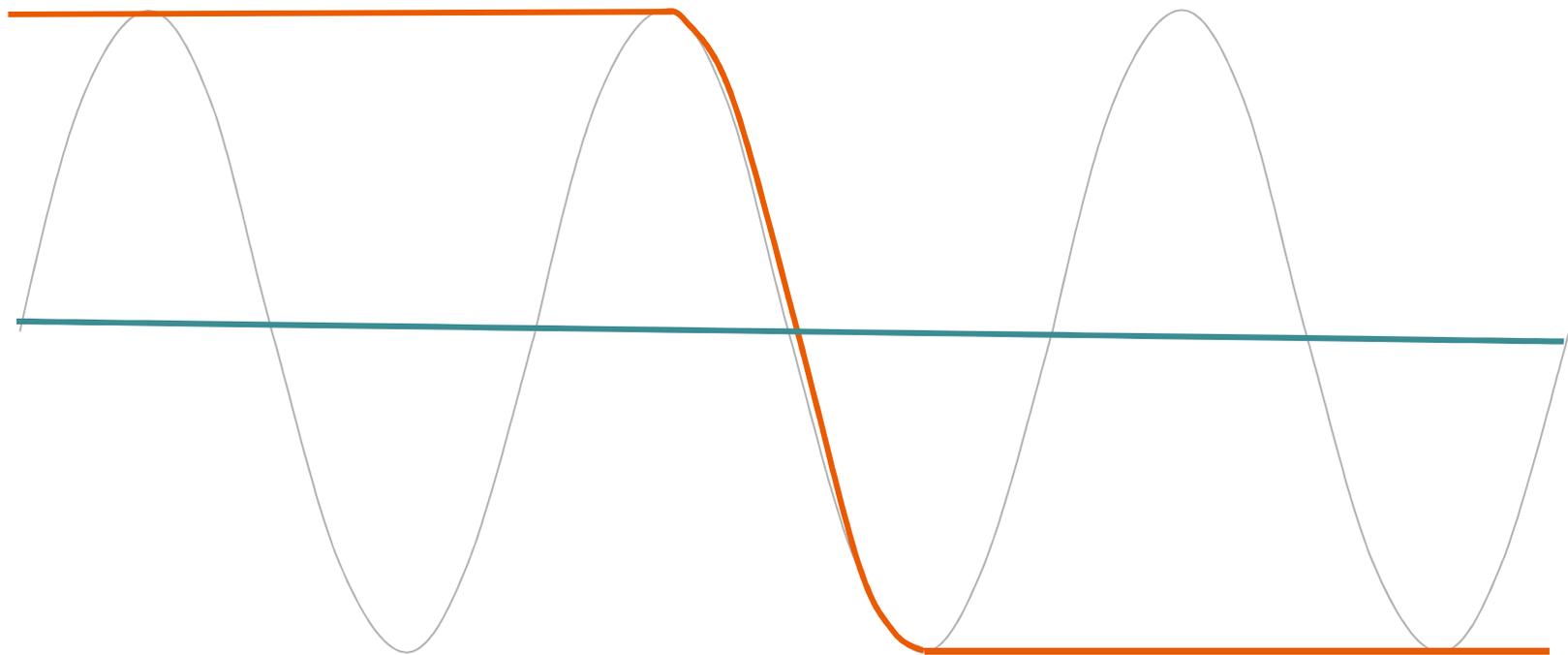
VLF 0.1 Hz Cosine Rectangular Wave Shape



VLF 0.1 Hz Cosine Rectangular Wave Shape



VLF 0.1 Hz Cosine Rectangular Wave Shape



← Timebase 50 ms →

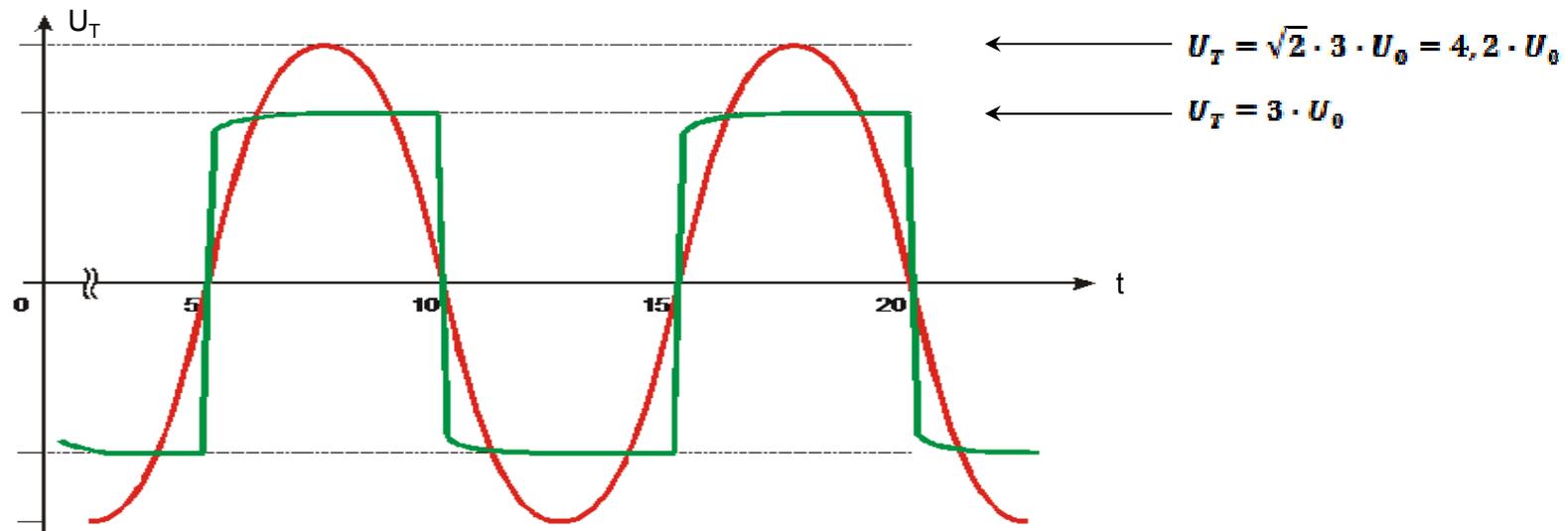
Significant Difference of VLF Sinusoidal in Comparison to VLF Cosine Rectangular



1,414 x U_0 higher load
to cable insulation, joints, terminations etc.



Test voltage levels as stated in VDE or other standards are in **RMS**



Why VLF 0.1 Hz Cosine Rectangular?

■ **SebaKMTs VLF 0.1 Hz Cosine Rectangular** wave technology is momentarily the only existing technology providing a test with:

- ➔ **Operational frequency**
- ➔ **Integrated leakage current measurement**
- ➔ **Cable preserving**
- ➔ **Low energy consumption**
- ➔ **Low weight & dimensions**
- ➔ **Integrated discharge & earthing facilities**
- ➔ **Safety devices** according to standards

■ **BUT STILL**

- ➔ With **high test power**
- ➔ For **all types of cables**, also mixed installation, investigating joints & terminations including switch gears



The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

Operating Software

Summary

The NEW HV DAC Series

Functionalities of TDS Power Source

- Up to user to decide
 - ➔ **TDS** together with **PDS 60** for PD diagnostics
 - ➔ **TDS** (“only”) for:
 - ➔ High power **VLF withstand testing** (with leakage current indication*)
 - ➔ **DC testing**
 - ➔ **Sheath testing**
 - ➔ As power source for **sheath fault pin-pointing** with the optional ESG NT step-voltage probe



* The leakage current indication gives the user a first indication about the quality of the insulation

Technical Data

Variant	TDS 40	TDS 60
Output voltage		
VLF	3 ... 40 kV _{RMS}	3 ... 60 kV _{RMS}
DAC	3 ... 40 kV _{peak}	3 ... 60 kV _{peak}
DC	3 ... ±40 kV	3 ... ±60 kV
Output current	7 mA	5 mA
Leakage current measurement	0 ... 7 mA, resolution 10 µA	0 ... 5 mA, resolution 10 µA
Frequency		
VLF	0.1 Hz	
DAC	50 to 500 Hz	
Testable cable capacitance VLF		
Basic version	2.4 µF / 40 kV _{RMS} @ 0.1 Hz	1 µF / 60 kV _{RMS} @ 0.1 Hz
Plus version	4.8 µF / 40 kV _{RMS} @ 0.1 Hz	2 µF / 60 kV _{RMS} @ 0.1 Hz
Testable cable capacitance DAC	5 µF / 40 kV _{peak} 10 µF max.	2 µF / 60 kV _{peak} 10 µF max.
Sheath test / fault pinpointing	Testing: 3 ... 10 kV Pinpointing: 3 ... 10 kV, pulse 1:3 / 1:5 / 1:9	
Safety devices	Breakdown detection, integrated discharge unit, earth loop monitoring	
Power supply	230 V, 50/60 Hz, 500 VA 120 V, 60 Hz, 500 VA	
Logging	Yes	
Temperature		
Operation	-25 °C ... +55 °C	
Storage	-40 °C ... +70 °C	
Relative humidity	93% / 30 °C (non-condensing)	93% / 30 °C to 50 kV (non-condensing) 70% / 30 °C from 50 kV to 60 kV (non-condensing)
Protection class	IP 20	
Weight (depends on options fitted)	Approx. 55 kg + 48 kg	Approx. 85 kg + 48 kg
Dimensions W x H x D, divided in two devices	550 x 1100 x 420 mm	550 x 1100 x 420 mm

■ Basic & plus version are available

■ Plus version with higher testable capacity

Two voltage levels are available

TDS NT-40 Basic or Plus

- For powerful VLF testing with accompanying PD measurement up to **23..25 kV** rated cables with test voltage **$3 U_0$**
- For PD diagnosis up to **36 kV** rated cables with **$2 U_0$** test voltage (**DAC**)

TDS NT-60 Basic or Plus

- For powerful VLF testing with accompanying PD measurement up to **36 kV** rated cables with test voltage **$3 U_0$**
- For PD diagnosis up to **45 kV** rated cables with **$2 U_0$** test voltage (**DAC**)

Functionalities of PDS PD Detector

- With help from **PDS 60** the TDS power source gets upgraded to **multifunctional diagnostic test set** capable of:
 - PD diagnosis up to $60 \text{ kV}_{\text{peak}}$ using **DAC**
 - PD diagnosis up to $60 \text{ kV}_{\text{RMS}}$ using **VLF CR**
 - **VLF monitored withstand testing** up to $60 \text{ kV}_{\text{RMS}}$

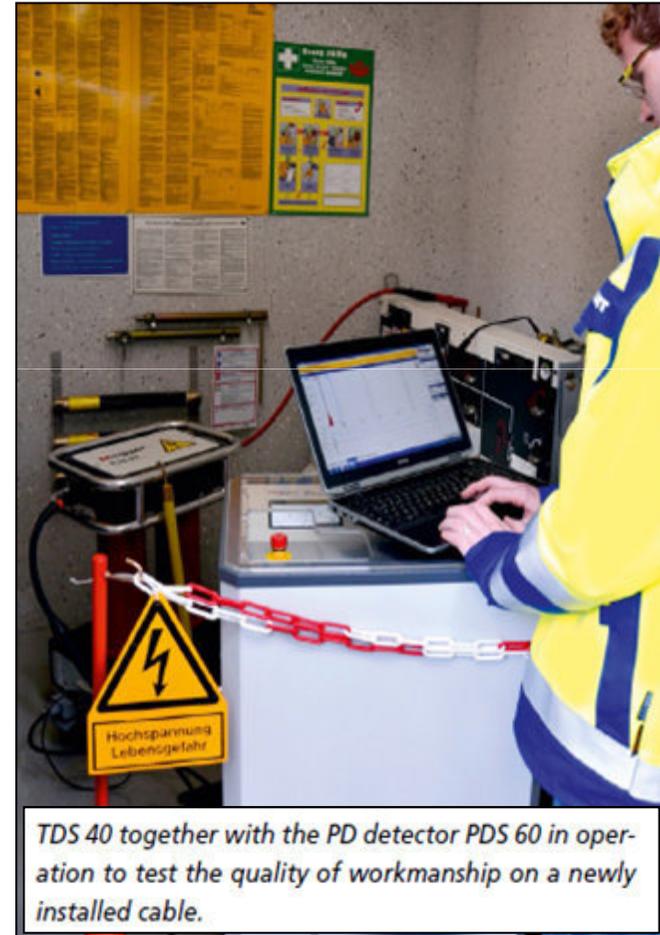
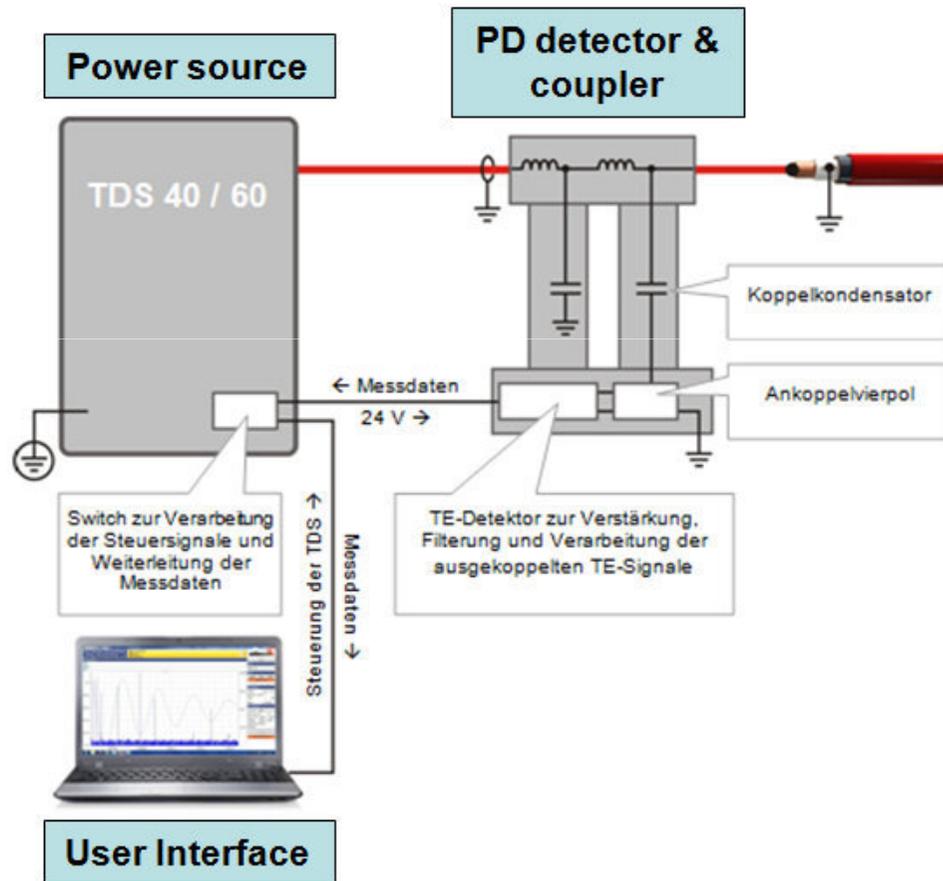


Functionalities of PDS PD Detector

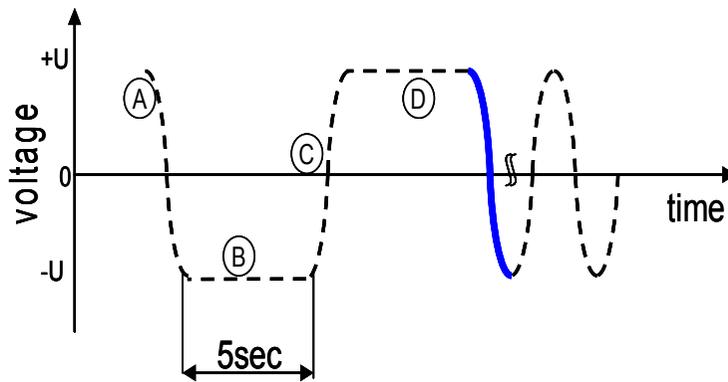
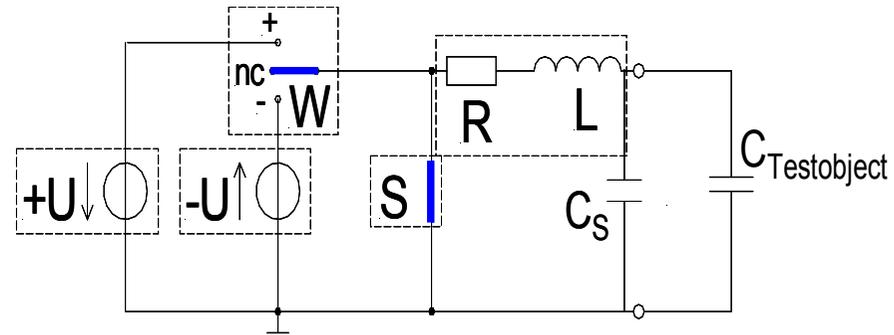
Technical Data PDS 60

PD detector PDS 60		
Voltage	Operation Type	max. 60 kV _{RMS} VLF CR or DAC
Capacity of HV coupling capacitor		25 nF
Sensitivity range		2 pC ... 100 nC
Resolution		± 0.1 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 TDS test system
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)		40 x 78 x 54 cm
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

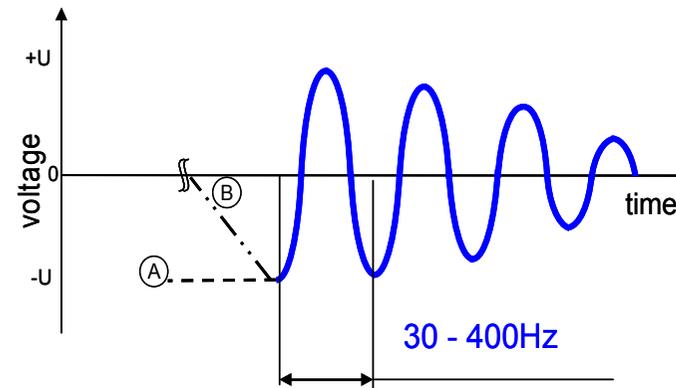
Connection Diagram



Principle



50 Hz-Slope-Technologie



DAC

The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

Operating Software

Summary

The NEW HV DAC Series

Cable Database

■ Integrated cable database with several functionalities

Search

Cable number	Location	Station A	Station B	Length [m]	U0 [kV]
45	Harbor district	Har. section 4	Hobson street substation	4200	12

Radeburg 1 Radeburg 2

2100 m 0

1 kV

Measurement Task

Tester:

Cable location:

Measurement point:

Cable Number:	45	Location:	Harbor district
CableType:	Three-core	Installation Date:	
Operational Voltage [kV]:	12	Length [m]:	4200
Comment:			

Har. section 4



Switchgear: Air insulated
Type:
Termination: Oil-filled

Hobson street substation

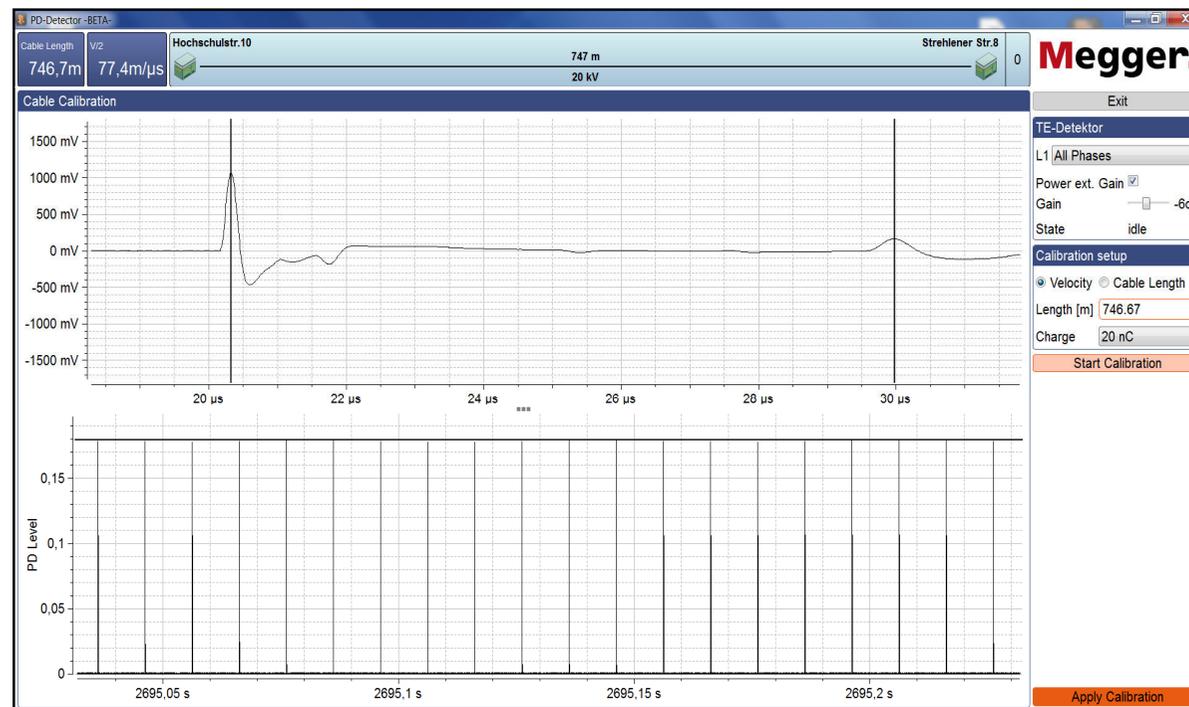


Switchgear: Air insulated
Type:
Termination: Oil-filled

Cable Segments

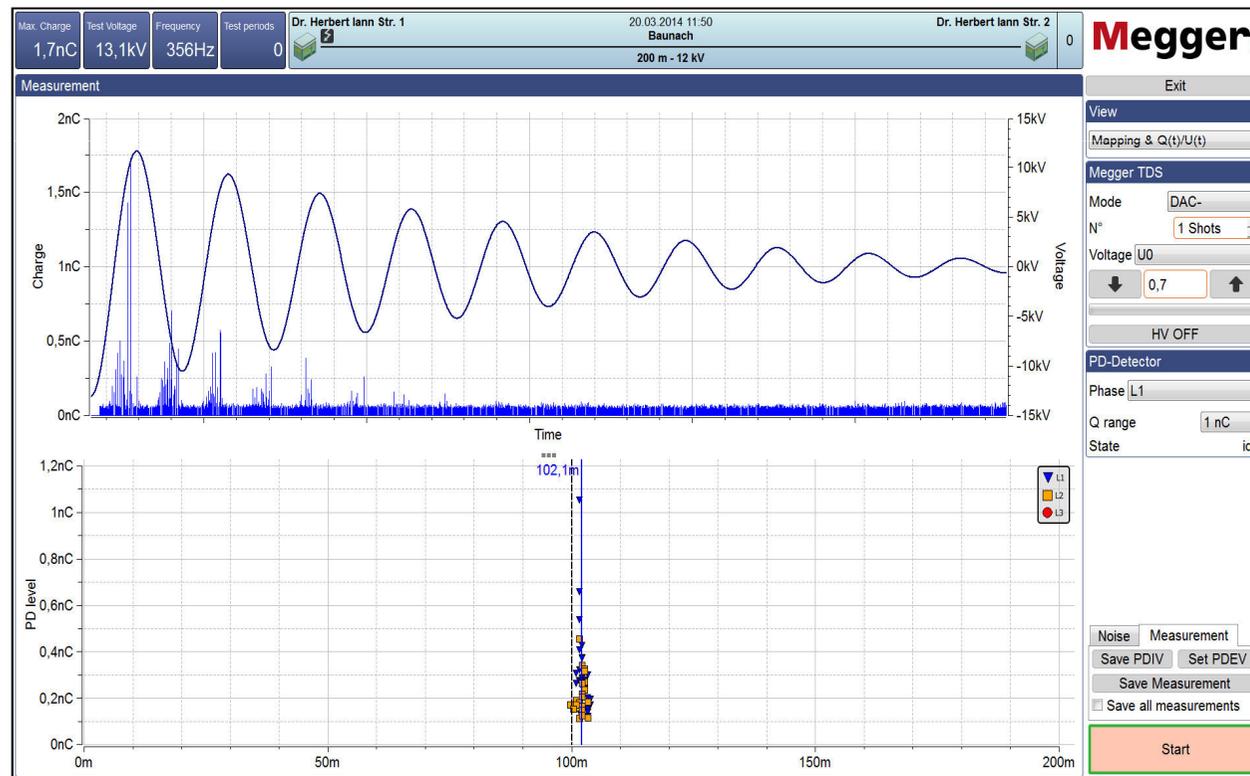
Calibration

- **Fully automatic** calibration
- Due to **linear amplifier** only one calibration needed
- Calibration by cable length or propagation velocity

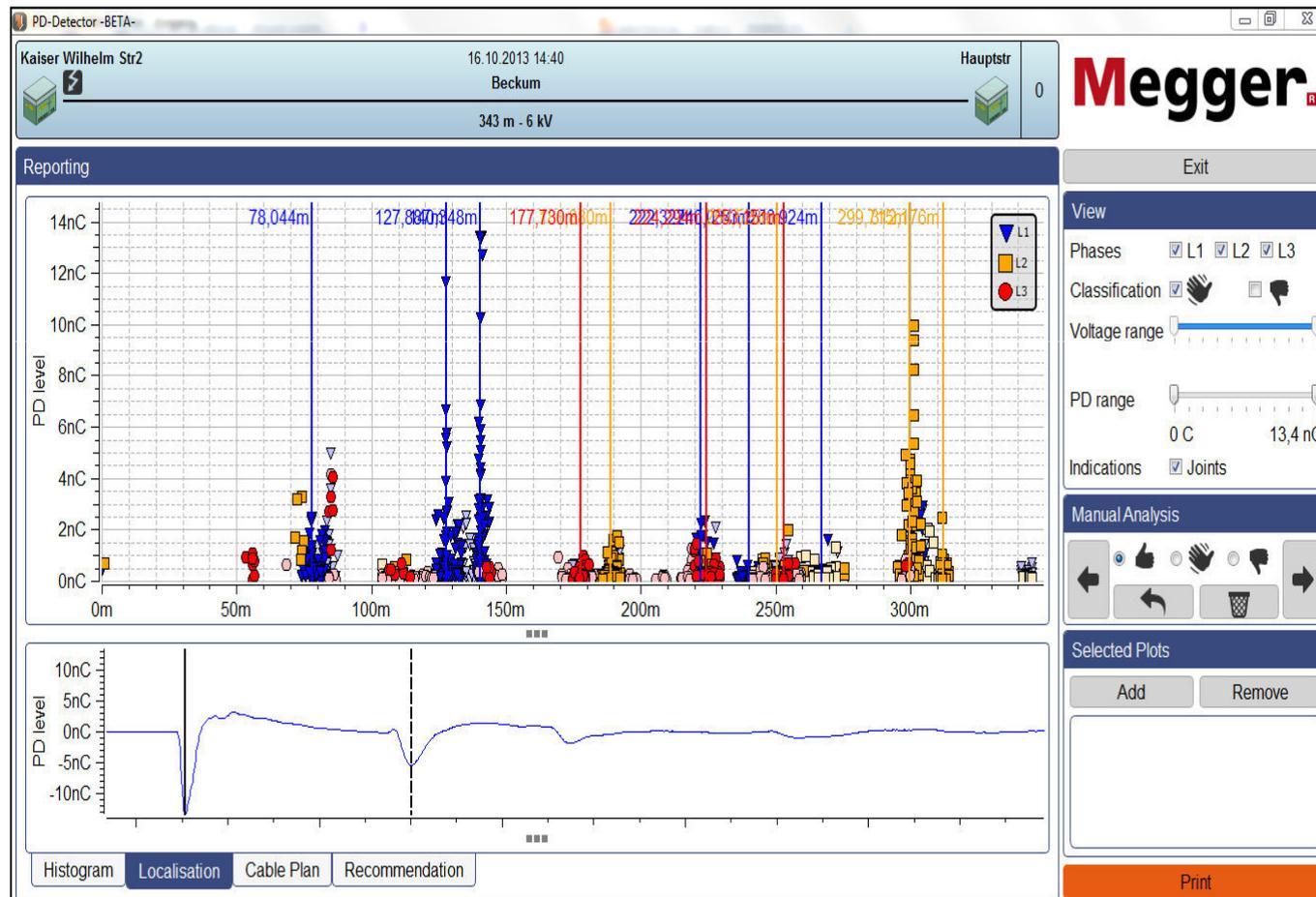


„Live“ PD Mapping

- The PD evaluation algorithm enables a **reliable automatic detection & precise location** of partial discharges (PD mapping) **whilst the measurement is taking place**



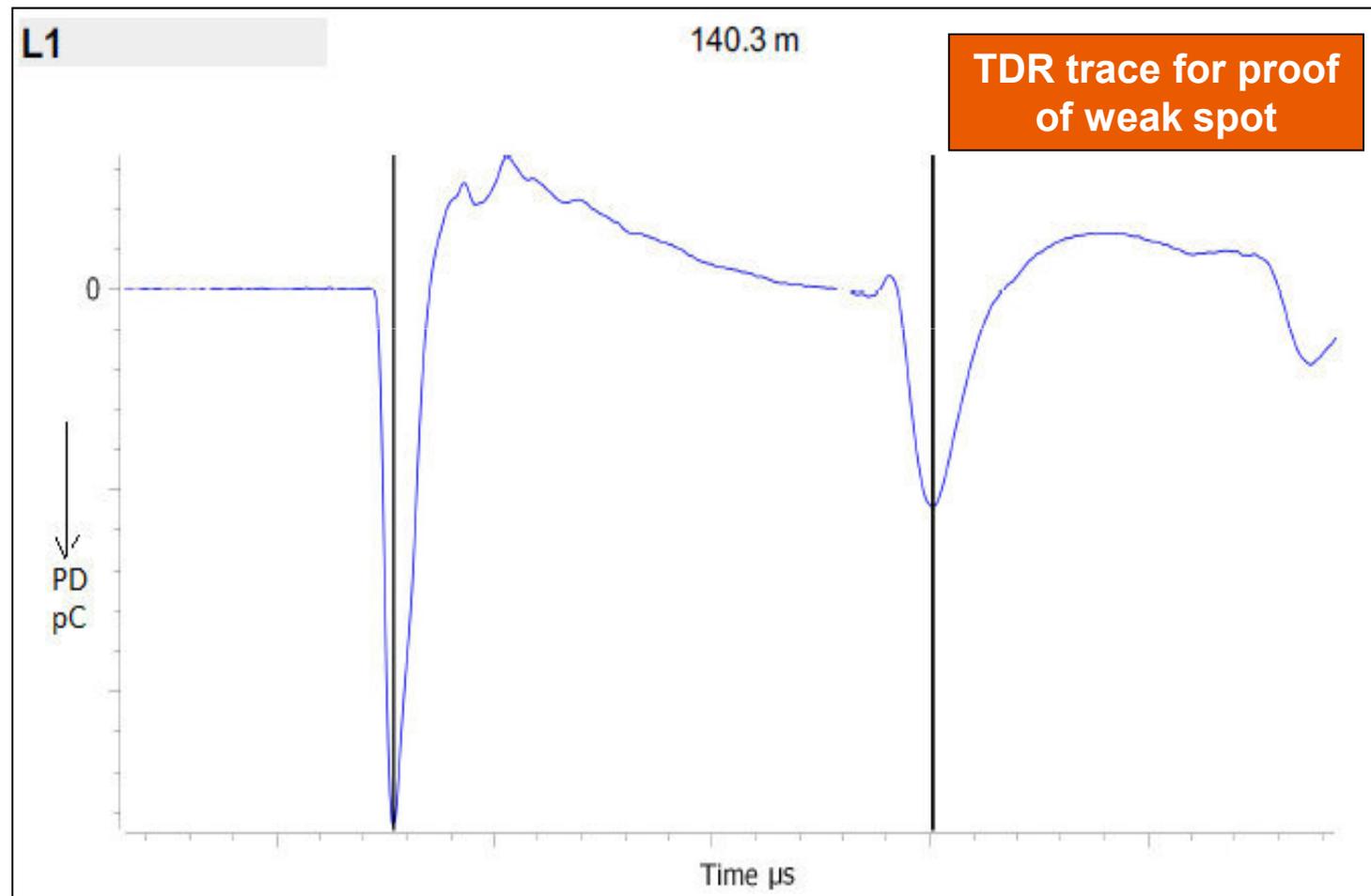
Evaluation & Reporting



Settings for display of results

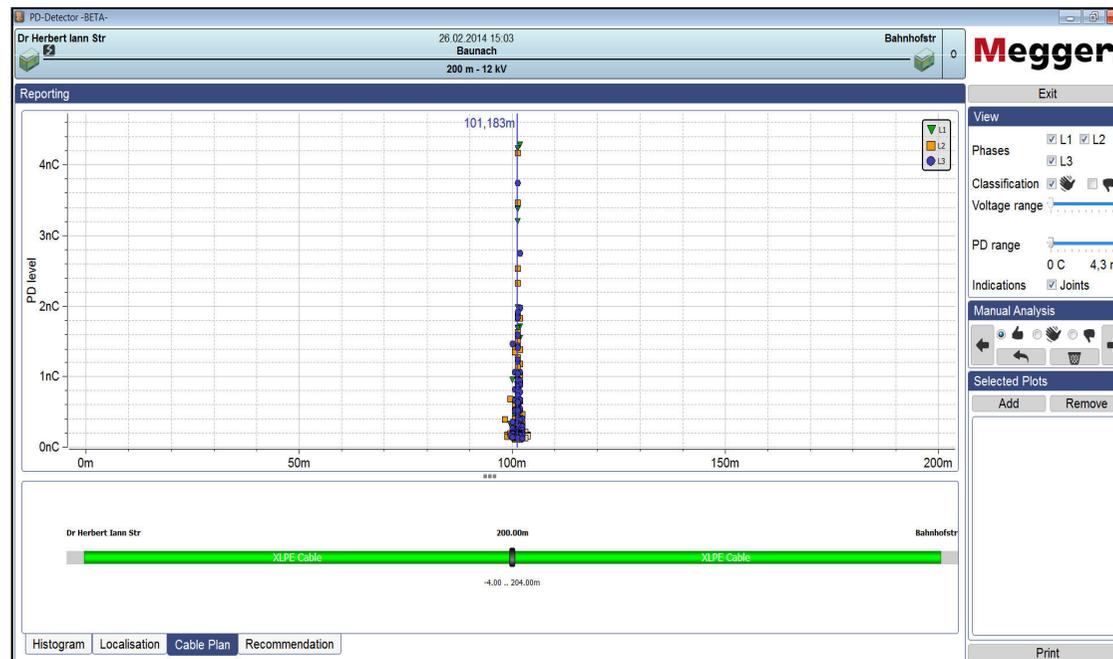
Settings for manual analysis

Evaluation & Reporting



Reporting

- 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



The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

Operating Software

Summary

The NEW HV DAC Series

Benefits of the PDS 60 Software against OWTS & 0.1 Hz Systems

- **EasyGo** SW principle (user is guided through the SW)
 - ➡ **Integrated cable database** with search, browse & edit function
- Fully **automatic calibration** process & **only one calibration** needed
 - ➡ Saving valuable time compared to OWTS
 - ➡ Calibration by cable length or propagation velocity
- PD measurements using **VLF CR** or **DAC** voltages possible
 - ➡ Both directly **comparable to 50 Hz**
- Automatic evaluation & **mapping** during the actual measurement (“**LIVE**”)
- No unnecessary switching between the PD measuring ranges
 - ➡ Minimizing or lower user errors
- **Reporting by mouse click** with additional functions for improved presentation of the results
- **Classification of PD** into three categories

The NEW TDS NT Series – Part I

Sidestep I – VLF CR

The NEW TDS NT Series – Part II

Operating Software

Summary

The NEW HV DAC Series

- **Replaces OWTS HV series** which we distributed for Seitz
- **Test & diagnosis system** using the proven DAC principle
- These test systems can be used for:
 - ➔ **Commissioning testing** of newly installed cable circuits (check quality of workmanship)
 - ➔ **Condition monitoring** on aged in-service **HV cables** (e.g. old oil or gas pressurized cables)

Benefits of new generation of HV DAC series:

- ⊕ Higher charging current
- ⊕ Designed for operating temperatures of up to 55°C
- ⊕ External cooling of system possible
- ⊕ Same operating SW as of the TDS series, which has there own unique advantages.

➔ HV DAC 200

- Designed for testing & diagnostics of up to **132 kV** rated cables
- Allows a monitored commissioning test acc. to **IEC 60840**

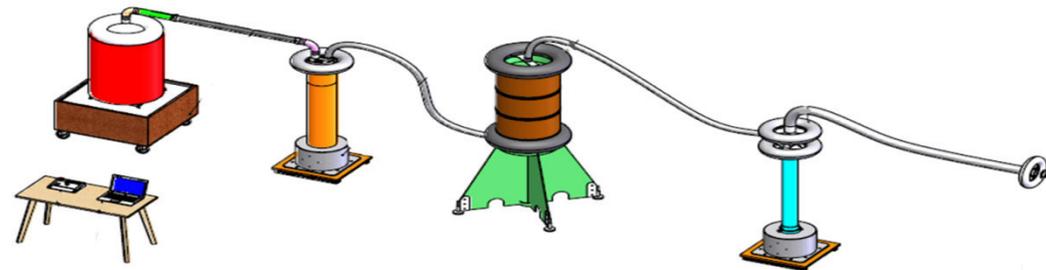
➔ HV DAC 270

- Designed for testing & diagnostics of up to **230 kV** rated cables
- Allows a monitored commissioning test acc. to **IEC 62067**

- Other voltages on request

- Delivery time of these units is **6-9 months after order income**
(sounds a lot, is however normal in this voltage level area)

Schematic Overview



HV Source

HV Switch

HV Inductance

HV Divider + PD
Coupler



Question Time

sebaKMT
A member of Megger Group



Köszönöm a figyelmet!

Philipp Legler

Applications Engineer – Technical Support

E-Mail: Legler.P@sebakmt.com

Telephone: +49 (0) 35208 8429140

Mobil: +49 (0) 151 14089240

Homepage: www.sebakmt.com

Newsletter: www.sebakmt.com/news/newsletter

Facebook: www.facebook.com/sebakmt