Partial Discharges

Different Opportunities of Measuring PD

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CONDITION MONITORING

THE **BLACK ART** OF DETECTING PARTIAL DISCHARGE

Detecting Partial Discharge (PD) requires extensive experience and equipment suitable to undertake measurements on live In-Service High Voltage Equipment. This was put to the test recently in one of Australia's largest underground mines.

How do you keep the Australian commodity exports running whilst maintaining an aging system? International demand for Coal, Oil and Petrol, Iron ore, Gold, Alumina, Aluminum, Nickel, LNG, Copper, Iron and Steel, Dairy products, all rely on HV systems that had a design life of 20 years, this was 10 years ago!

Any supporting infrastructure that reduces or stops the mine from recovering ore in times of a mining boom has a far greater financial effect in real dollars per hour, compared to mining in normal times.

The question being asked is "How do we manage the remaining asset life for the next 15-20 years, on existing assets?"

- The most important step would firstly be to use an experienced capable field contractor used to operating in the underground

CASE STUDY TWO

Operating high voltage equipment in abnormal situations, requires an increase in overall maintenance strategy. The strategy required needs to suit both the environment and duty of operation, as the equipment ages the interval and type of maintenance given need to be reviewed.

TYPICAL FAULTS TRACED BY PD	
PARTIAL DISCHARGE FOUND	RISK TO MINE
Tracking within bus chamber at adjacent to bus tie	Complete substation failure
End tracking on bus-chamber –	Complete substation failure

Source: www.powertrans.com.au

Agenda

- ***Introduction***
- ***Conventional PD***
  - *TDS-NT Series*
  - *TDM-4540 Unit*
  - *Centrix 2.0*
  - *Compact City & Centrix City*
- ***Non-conventional PD***
  - *UHF PD Detector*

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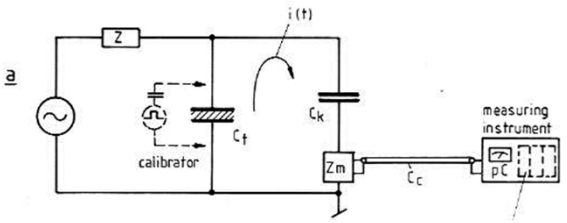
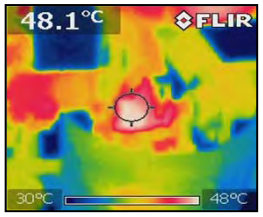
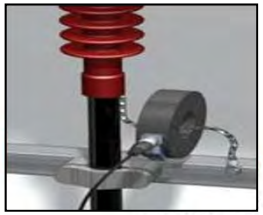
Introduction

- **Basically 2 Ways of measuring PD**
  - *Conventional*
  - *Non-conventional*

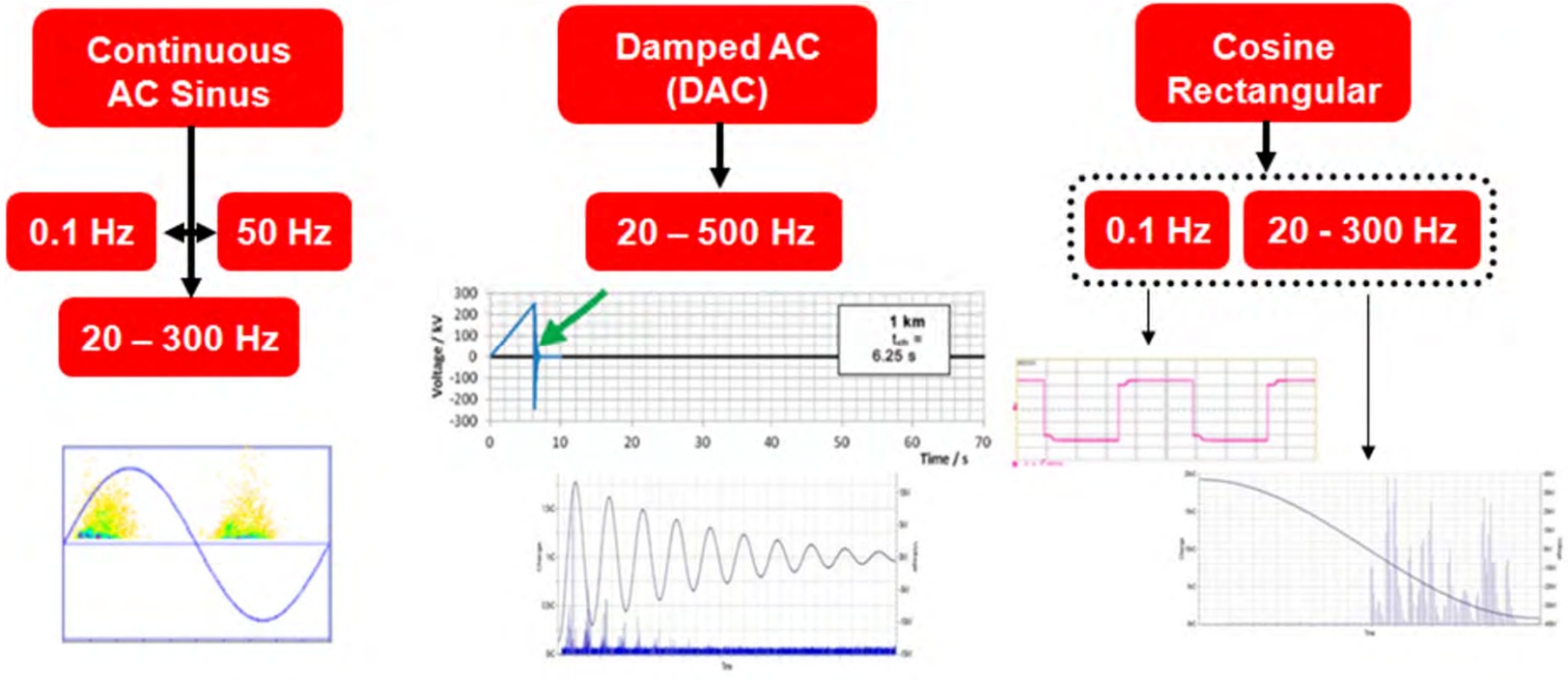


- *Conventional Methods* always consist out of *Coupling Capacitor* (as per *IEC 60270* Standard)
- Only in conventional Way allowed to speak from *pC* (Calibration needed)
- *Non-conventional* Ways of measuring PD are *all other Methods not* making use of *Coupling Capacitors* & *not calibrated* as per IEC 60270 Standard
- Includes most of *Online Methods*



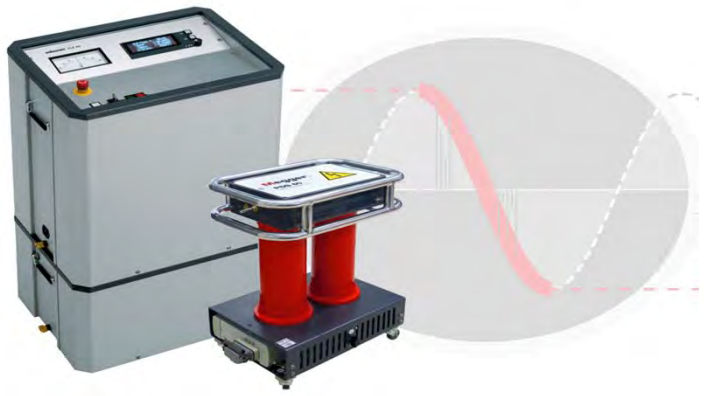


Excitation Voltages - Overview



TDS-NT Series

- TDS-NT Series is Generation of *combining Testing with Diagnostics*
- Combined Power Source
  - DAC (well proven non-destructive PD Diagnosis)
  - VLF CR (high power VLF monitored Withstand Testing, combined with PD)
- But can be also used for (stand-alone):
  - DC Testing
  - Sheath Testing
  - As Power Source
    for Sheath Fault Pin-pointing with
    optional ESG NT Step Voltage Probe

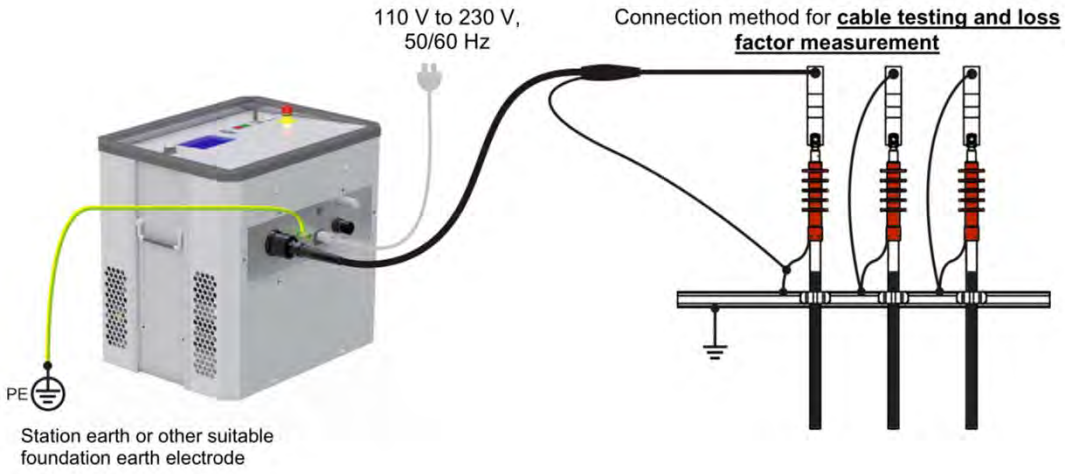


TDM-4540 Unit

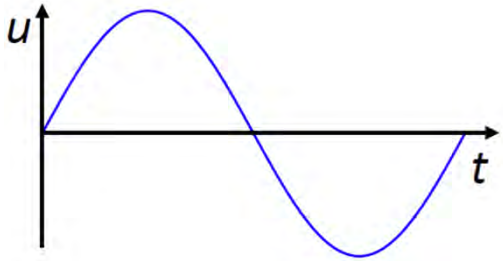
- TDM-4540 is NEW Generation of *combining Testing with Diagnostics*
- *Cable Testing*, *Cable Diagnosis* & *Sheath Testing* in one Device
- Enables standard compliant *high Power VLF Testing at 0.1 Hz*
  - ➡ 5 µF @ 40 kV_{rms}
- *Internal tanDelta* Measurement with automatic Result Interpretation
- *Partial Discharge* Diagnosis using:
  - ➡ Damped AC
  - ➡ VLF 0.1 Hz CR – 50 Hz Slope Technology
  - ➡ VLF 0.1 Hz Sine Wave

TDM-4540 Unit

- **VLF Sinus 45**



VLF 0.1 Hz Sin



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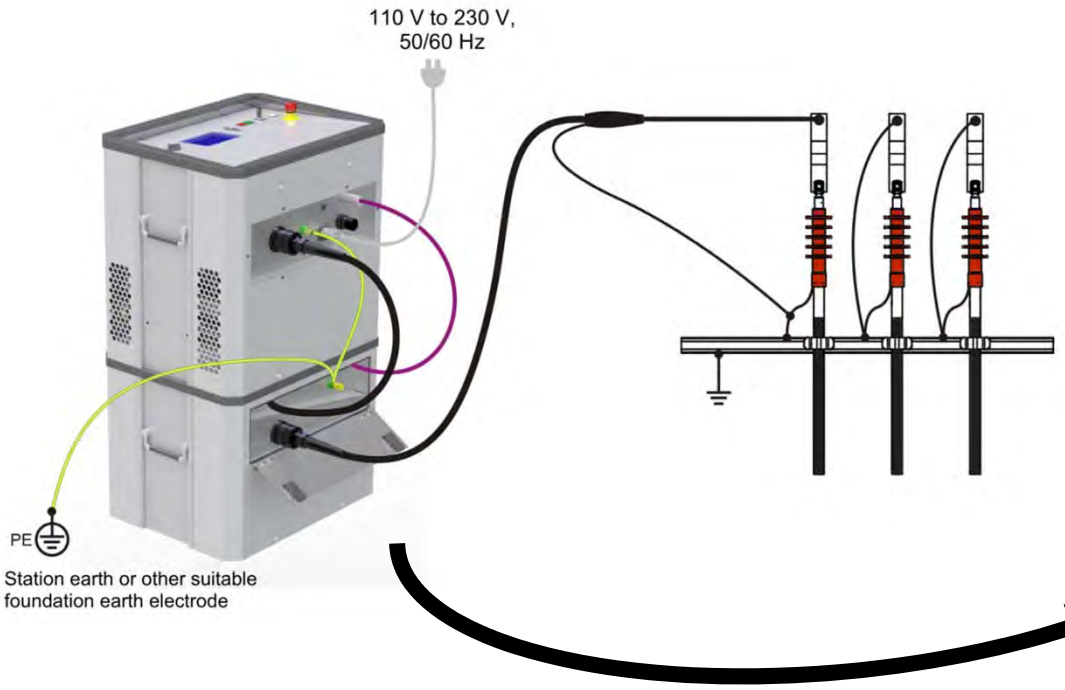
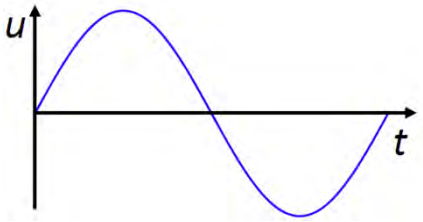
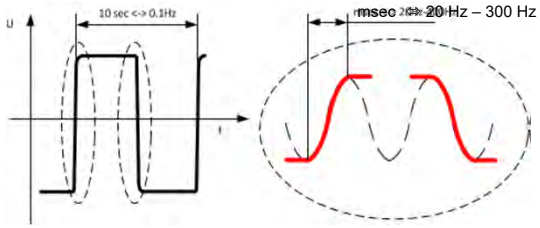
TDM-4540 Unit

- **VLF Sinus 45 + Booster**



VLF 0.1 Hz Sin





VLF CR / Slope 0.1 Hz

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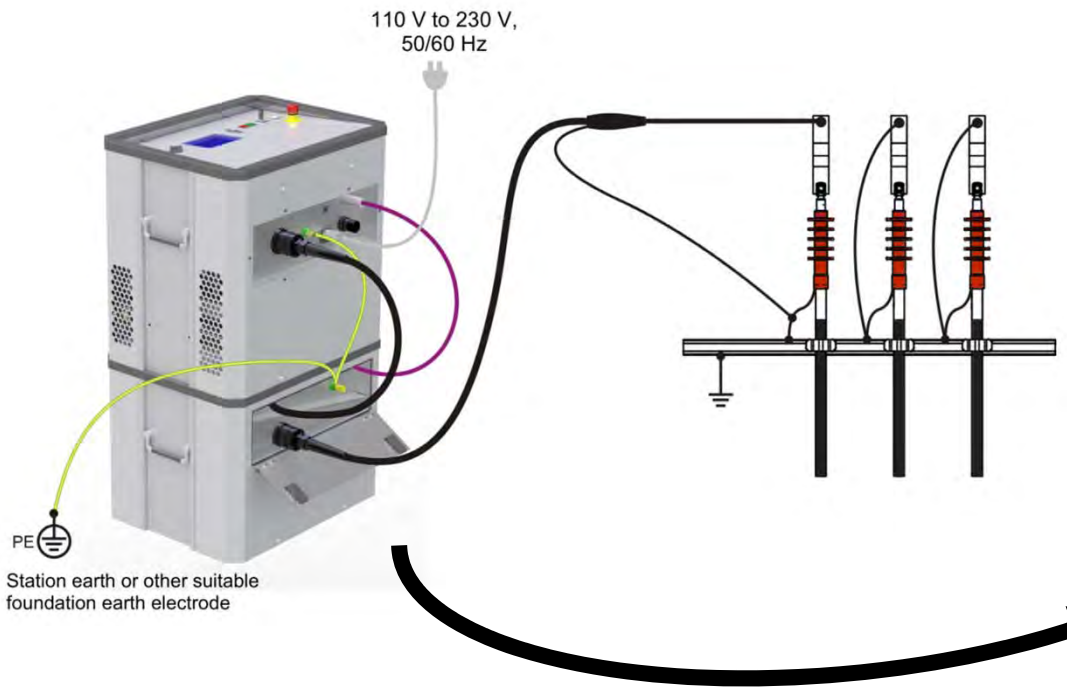
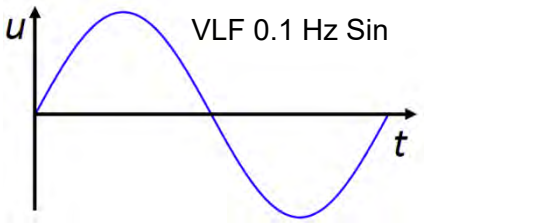
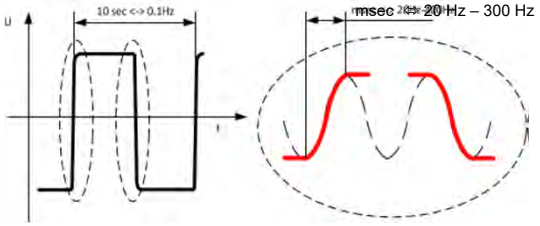
TDM-4540 Unit

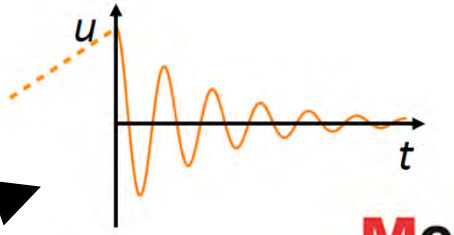
VLF Sinus 45 + Booster + DAC Option







VLF CR / Slope 0.1 Hz



DAC

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Sprinter

CENTRIX 2.0 - Central & Flexible

Centrix 2.0 thinks ahead & provides unparalleled levels of user confidence and comfort

Highest safety standard with SafeDischarge Technology	Linux based operating system - Maximum system stability & security
Intuitive one-hand operation by 21.5“ touch display and JogDial	Step by Step operator guide even for inexperienced users
Li-Ion Battery Power supply	Remote control of important system functions
Decay plus double surge method up to 80 kV	Simultaneous testing and diagnosis with 50Hz slope technology

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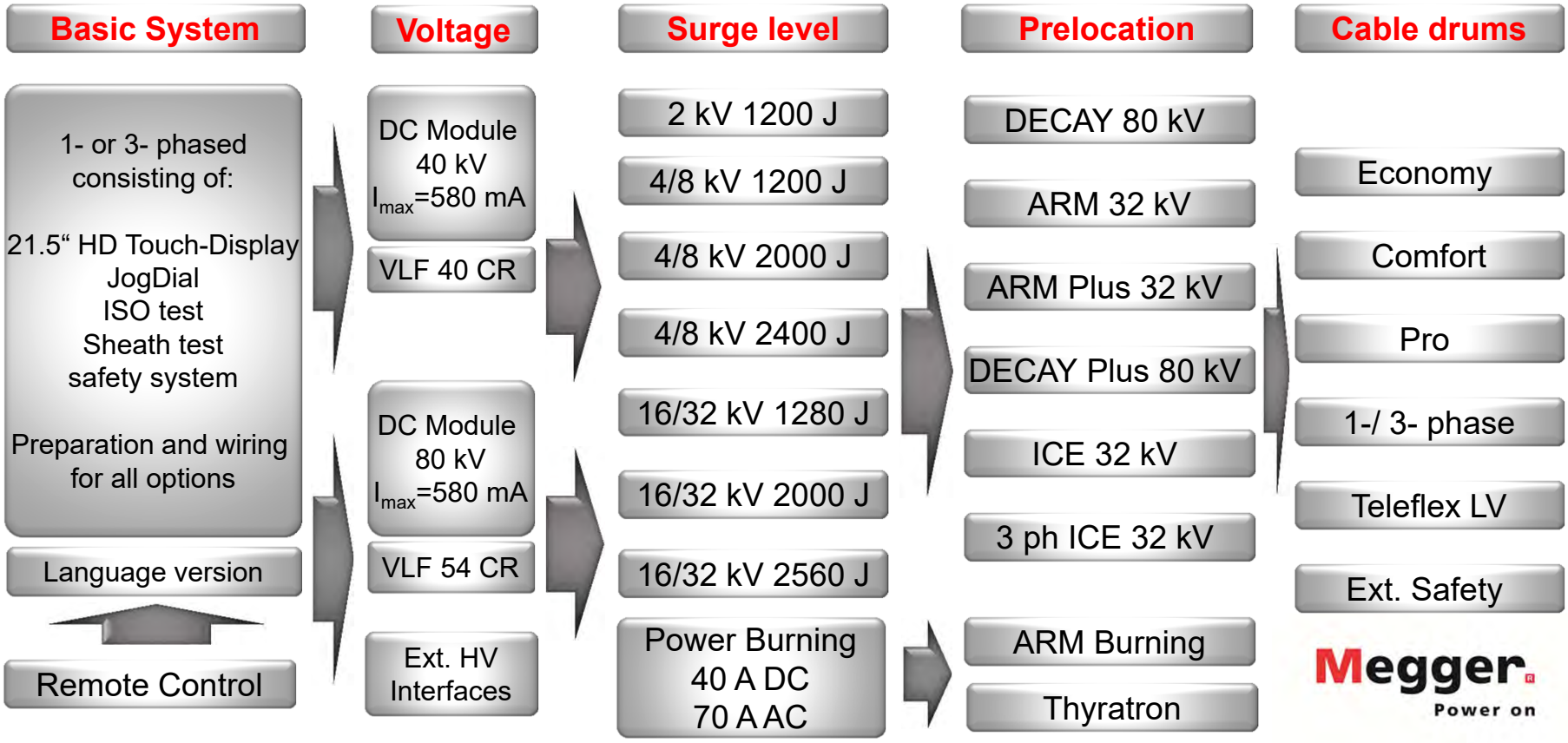
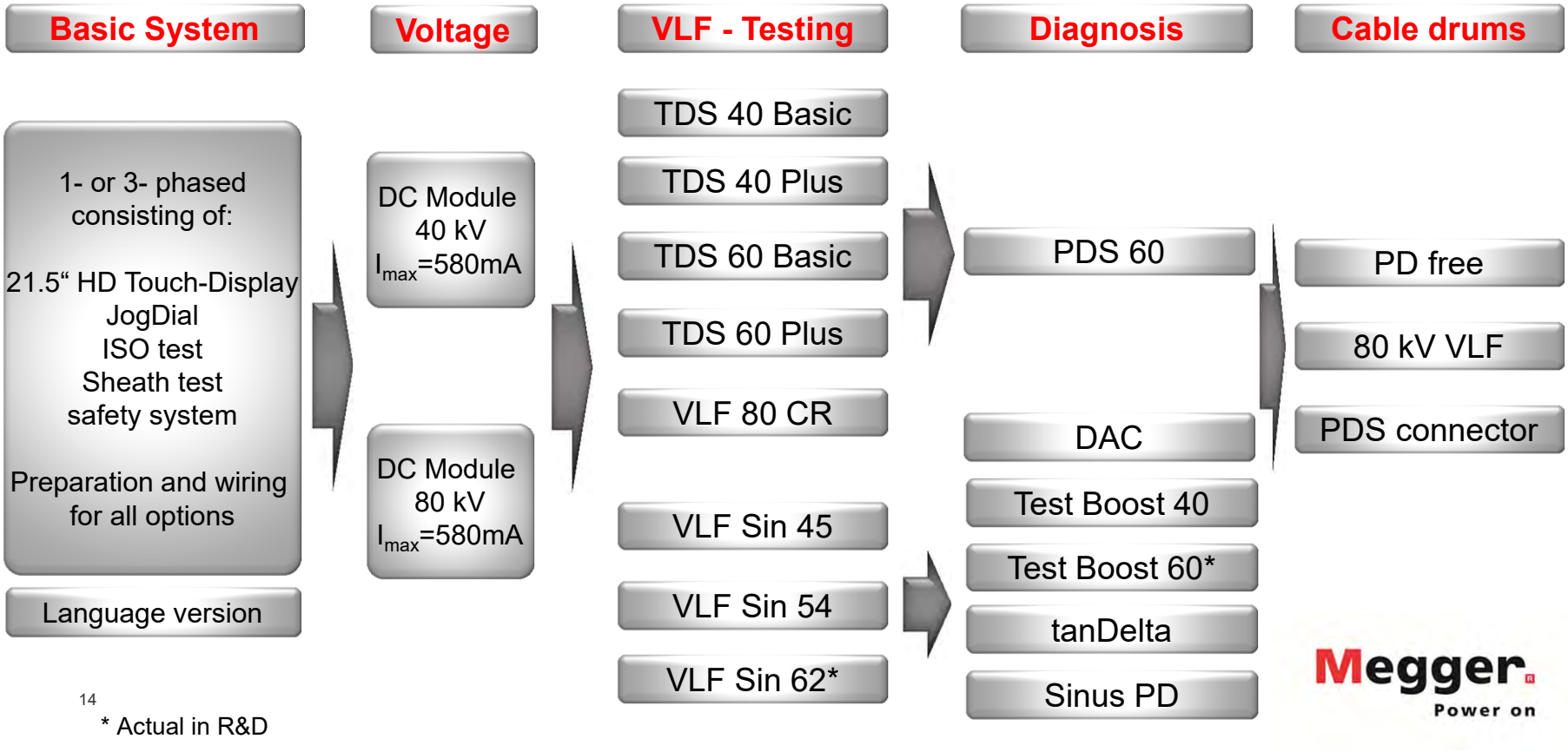
Standard System Options



Test & Diagnostic Options



* Actual in R&D

City Series

- **General Requirements**
- Compact, 1-phased Test System for Cables rated up to 33 kV
- Fully integrated
- Cable Fault Location up to 40 kV DC
- VLF Testing up to 5.5 µF @ 36 kVrms
- Cable Diagnostics with all available Methods
- Same Safety Standard, as the „big“ Systems
- Comfortable Operation even with small Vehicle Dimensions

City Series

CENTRIX CITY

Fully automatic
User guidance & support

COMPACT CITY

Dual system operation
with detachable control units

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City Series - Differentiation

Centrix City Fully automatic operation concept	Compact City Dual operating concept
▪ Fully integrated Centrix control unit for all operation modes + database ▪ Automatic switching of operation modes ▪ 17“ or 21.5“ Multitouch - Display ▪ Fully integrated reflektometer ▪ 3-phased TDR measurmement ▪ Pro Range – Compensation of cable attenuation ▪ TDR range: 1280 km	▪ Dual system operation with detachable control units (Teleflex SX; Laptop for diagnostics & database) ▪ Simplified manual switching between operation modes ▪ 10“ Touch - Display ▪ 2-phased TDR measurement with detachable TDR ▪ Pro Range – Compensation of cable attenuation ▪ TDR range: 160 km

PD Detector Software

- **Benefits of PDD Software**

- *Several Device, but ONLY ONE SOFTWARE*
- *EasyGo SW Principle*
  - ➡ User is guided through the SW
- *Integrated Cable Database* even simple Searching, Browsing & Editing of Measurement & Cable Data
- *Fully automatic calibration* Process, only one Calibration needed
  - ➡ Saving valuable Time
- *Automatic Evaluation* & precise PD Mapping during the actual Measurement
  - ➡ “On the FLY”
- Users can choose between *three Views*
- *Reporting by Mouse Click* with many additional Functions (e.g. customized Templates)

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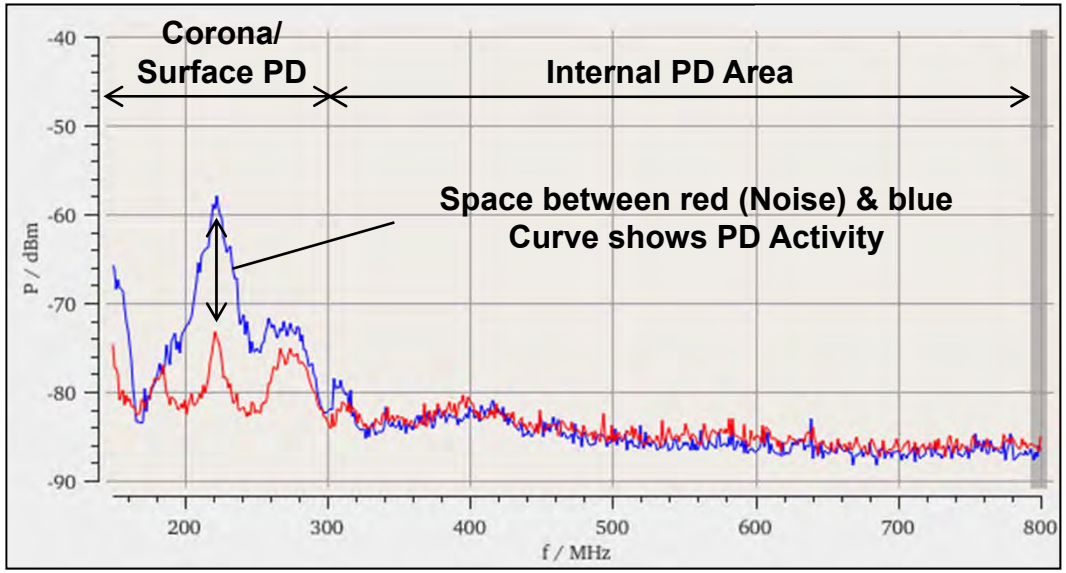
Why UHF PD?

- Termination Failures are expensive & lead to long Outage Times
- Quality Assurance: Experiences of 50hertz
- Termination Failure, although being tested!!!

Why UHF PD?

- *Dangerous internal PD* can *easily be distinguished* from Corona & Surface Discharges



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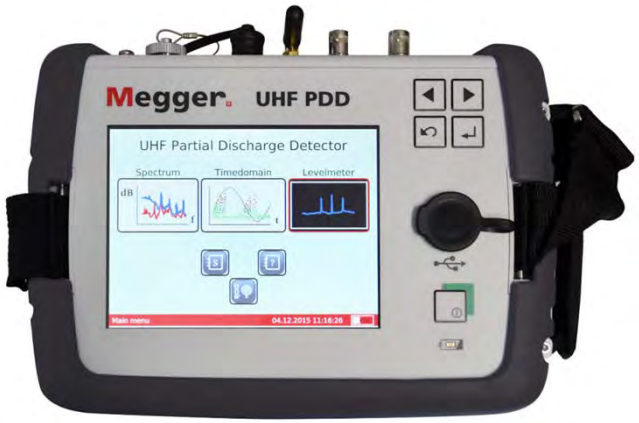
Online Handheld UHF PD Detector

- Quick Surveying Tool for MV & HV Plants
- Touch Screen for easiest Operation
- Longest Battery Power amongst others
  - ➡ Up to 12 Hours Operating Ttime
- Inbuilt Calibrator ensuring highest Measurement Reliability
- 50/60 Hz Mains Synchronization
- Dual Channel



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Technical Overview

- Synchronization via wireless Mains Sensor or via external Sync Sensor
- Demodulated PD hearable via Stereo Headphones
- Hard Case for Storage of all Components

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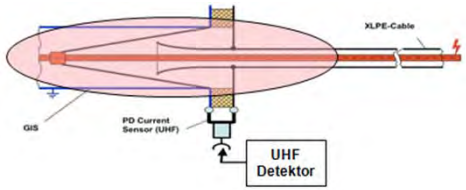
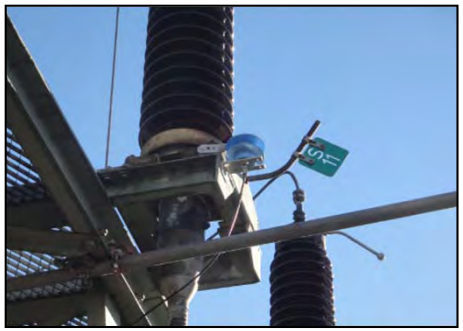
UHF Sensor

- **Technical Overview**

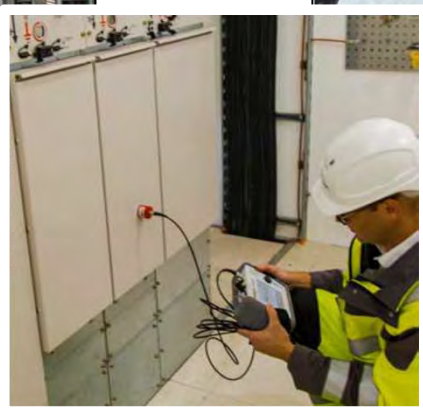
- For permanent Installation
- UV resistant
- Maintenance free
- Applicable up to 500 kV Rated Cables
- Operating Temperature: - 40° C … 85° C

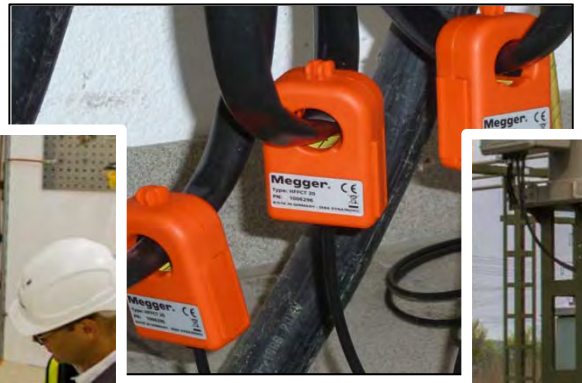




Variety of Applications

- *Probe & Dipole Antenna* for screening of *Electrical Components*
- *Capacitive* PD Measurements on *Transformers & Switch Gears*
- *Inductive* PD Measurement (RF Range) to locate *Cable PD* (*permanent Installation*)





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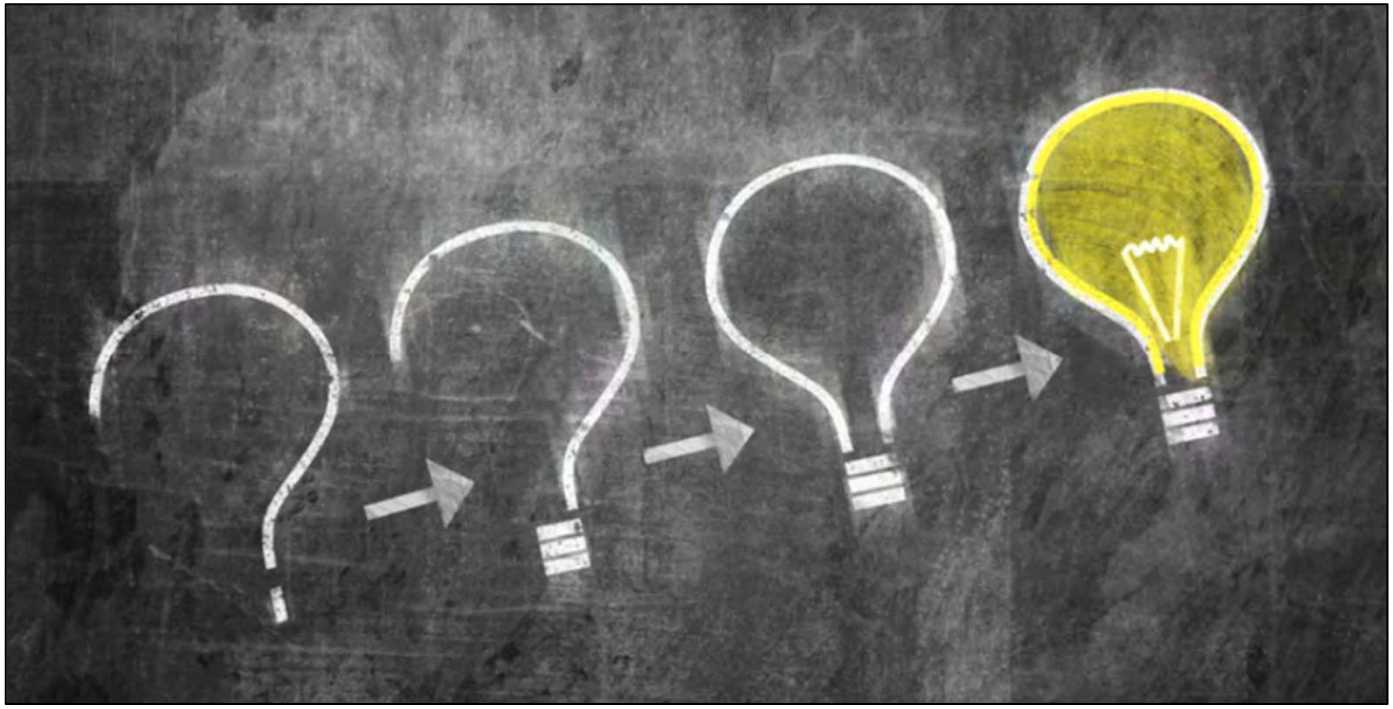
Question Time



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Köszönöm a figyelmet!

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