

# MPD 600

High-end partial discharge measurement and analysis system



# Partial discharge analysis

## Partial discharges: weak points in insulation systems

Partial discharges, as defined by IEC 60270, are localized dielectric discharges in a partial area of an electrical insulation system under high electric field intensity. PD phenomena are in many cases the preliminary stage of a complete breakdown of the insulation. For this reason, for many years generators, transformers, switchgear and cable systems have been checked for partial discharge.

Our MPD 600 is a high-end measurement and analysis system for partial discharges. It corresponds to the relevant standards for electric PD measurements and also provides analysis techniques far beyond this.

## Rising to the challenge: the OMICRON solution

The challenge when analyzing PD is to detect and evaluate discharges in the range of pico-coulombs (pC), while dealing with test voltages of up to several hundred kilovolts (kV).

These sensitive measurements are often complicated by severe external interference or noise from nearby equipment, caused by corona or other radio frequency (RF) sources.

The MPD 600 incorporates a range of leading-edge technologies which provide accurate, reliable and reproducible measurements – even under the most demanding circumstances.



## The system

The MPD 600 system consists of a measurement unit, a USB controller and sophisticated analysis software. The modular plug-and-play system enables a number of state-of-the-art display and assessment features and achieves outstandingly high measurement accuracy.

## Practical multi-channel operation

The system can be easily expanded to a virtually unlimited number of channels. This enables parallel and truly synchronous measurements. Fiber optic connections allow distances of up to 2 km / 1.2 miles between adjacent measuring devices.

## Field-proven technology

Hundreds of units are operating worldwide in industrial and utility applications. MPD 600 reliability is being proven regularly by major cable, transformer and rotating machine manufactures in some of the world's largest PD measuring projects.



## Your benefits

- > IEC 60270-compliant PD measurement and automated reporting
- > Synchronous multi-channel PD measuring and recording
- > Excellent interference immunity for measurements under difficult conditions
- > Safe operation through optical fiber isolation
- > Fully digital data processing enables high measurement accuracy

 [www.omicronenergy.com/mpd600](http://www.omicronenergy.com/mpd600)



# Effective prevention of interferences

A main problem during PD measurements is interferences caused by adjacent electrical equipment. These can make measurement, analysis and localization of PD signals very difficult or even impossible. The elimination or at least reduction of such interferences is critical for successful PD analysis.

## Galvanic isolation through fiber optic cable

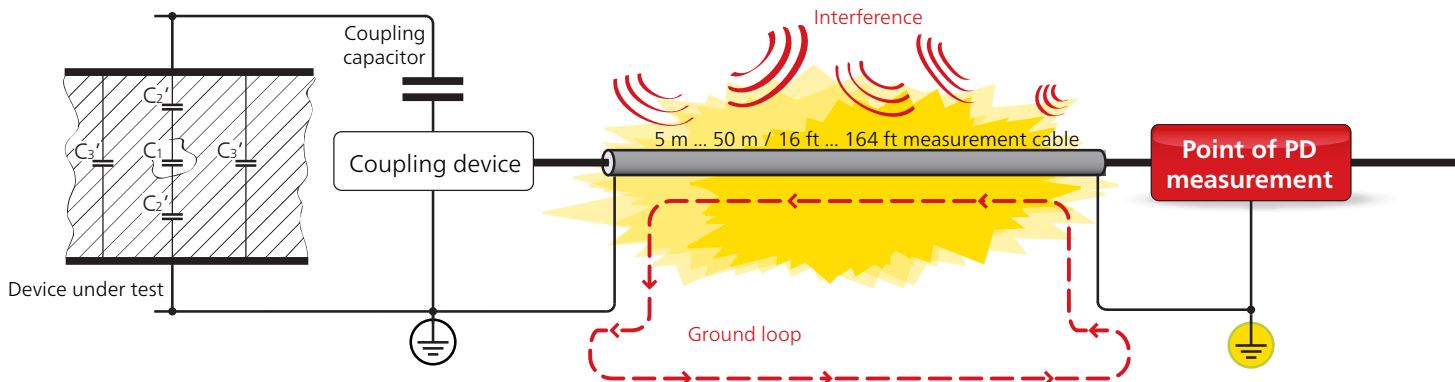
Fiber optic transmission of data between the individual measuring devices and the PC controller provides complete galvanic isolation. This minimizes ground loops, reduces interference coupling and achieves significantly higher system sensitivity through the improved signal-to-noise ratio.

Fiber optic connections have been proven reliable in industrial environments. Electrical or radio frequency connections (e.g. WLAN) are less reliable because of frequent disturbances from machines or electrical discharges (e.g. PD).

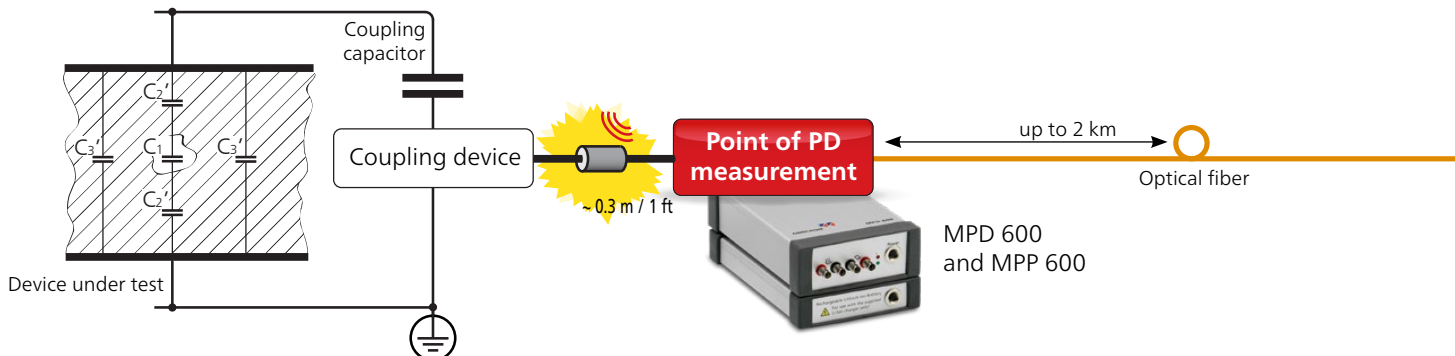
Fiber optic connections also may be very long, without degrading the instrument's performance.

Another convincing advantage of fiber optics compared to copper wires is the precise synchronicity of all connected units down to the range of nanoseconds. This simultaneous communication ensures a continuous, uninterrupted acquisition of time-critical PD events and the related test voltage, even under most demanding circumstances.

## Conventional PD detection



## Innovative PD detection with the MPD 600

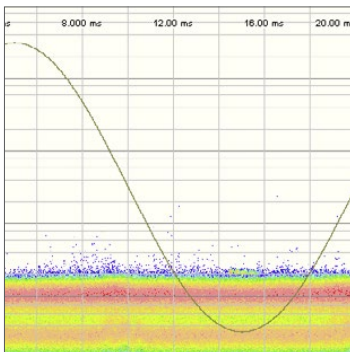


### Advanced, fully digital filtering

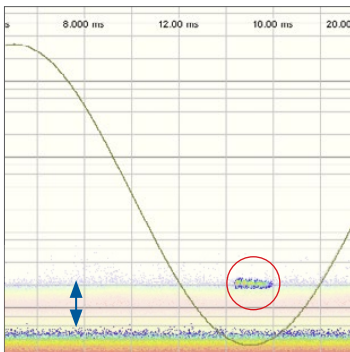
From the first measuring point, MPD 600 uses a digital filter. Therefore no aging effects or drift over time and temperature occurs. This results in an exceptionally high degree of reproducibility to perform reliable, calibrated and traceable PD quality control.

### Battery powered acquisition units

During battery operation, no noise from the mains power supply enters the measuring circuit. This way the measurement unit can also be operated at high-voltage potential. Due to the very low power consumption, an uninterrupted battery operation of more than 20 hours is ensured.



PD signals obscured in the noise band



PD signal with reduced noise level

### Measuring up to the UHF range

Interferences can often be avoided through changing the center frequency. A largely expanded measuring range up to the ultra-high frequencies (UHF) is realized with the optional UHF 620. This unconventional UHF measuring method can be used for commissioning tests as well as on-site and online diagnostics.

The combination of UHF 620 and MPD 600 results in a precise measurement system for different frequency bandwidths: Either narrow band, medium band or wideband measurements can be selected.

The UHF 620 is ideally suited for measurements of power transformers and gas insulated switchgear (GIS).

Different UHF sensors for conventional measurement systems, like spectrum analyzers, can be combined with the UHF accessories.

### Reducing the impact of disturbances

The MPD 600 system can be used with the MBB1 measurement balanced bridge to perform differential PD measurements during single-phase PD testing. Together they reduce interference in unshielded areas in the laboratory and on site as specified by IEC 60270.

The impact of disturbances is reduced by using the difference of the measurement signal of both branches in a balanced setup. Differential PD measurements lead to an improvement of the signal-to-noise-ratio and to a significant reduction of common-mode disturbance signals.



MBB1 measurement balanced bridge

# Tailored MPD software

## Basic Package – results by mouse click

The Basic Package gives you the features of the Basic Mode. Most parameters and settings are automatically determined by the software, so you can focus on performing the PD measurement.

- > Highly responsive real-time display (> 20 frames /sec)
- > Configurable real-time oscilloscope view for PD and V input
- > Flexible PD event visualization, including the phase resolved histogram view, ellipse and real-time view
- > Ellipse view for reproduction of a classical analog feel

## Advanced Package – extended possibilities

With the Advanced Package, you can access the Expert Mode with a lot of additional settings, views and analysis methods. This allows manual control over every aspect of PD detection and analysis, while providing access to advanced visualization options.

Possible displays in Expert Mode:

- > 3PAR – 3-Phase Amplitude Relation Diagram
- > Controlling of the advanced noise suppression by Dynamic Noise Gating
- > Full oscilloscope style functionality for PD input signals
- > Q(U) and H(Q) diagram

### Large scope view area

Independent of the connected units the large window displays:

- > The progress of the test voltage
- > The phase-resolved histogram in different presentations
- > The 3PAR display
- > The gating

### Small scope view area

The small window can be configured to display different data depending on the setting:

- > Frequency spectrum of the input signal at the PD input
- > Threshold display with inception and extinction voltage
- > Voltage and charge value trend curve in replay mode



Apart from numerous detailed displays and manual settings, the following functions characterize the Expert Mode particularly well:

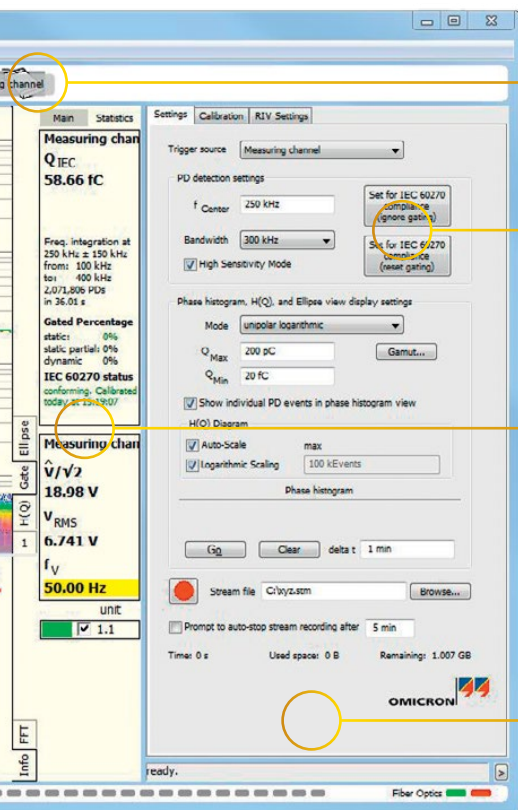
- > Hardware gating (with external gating unit)
- > PD detection and analysis for DC applications
- > Long-term acquisition of all relevant PD related trending purposes
- > Statistical PD fault location for cables
- > Additional PD event evaluation in accordance to IEC 60270 (e.g.  $Q_{IEC}$  average)

## Guided measurements

### Cable Mode

The Cable Mode is an intuitive, three-step interface for testing high-voltage cables. This module is used for quality assurance in the factory as well as fault localization on site.

You are guided through the entire measurement. The detection of partial discharge faults in high-voltage cables, which is accurate to the meter, is thus particularly effective and precise.



### Acquisition unit selection

The upper display pane shows the connected acquisition units as well as their status

### IEC button

Fast, automatic measuring according to IEC 60270, i.e., the center frequency and bandwidth are set automatically

### Measured quantities display

The two windows for measured values and statistics show the current values for quantities conforming with IEC 60270 such as: PD charge, voltage or frequency

### Settings area

Monitoring and control of the different software modes:

- > Easy handling in Basic and Cable Mode
- > Complete control in the Expert Mode

# Active noise suppression

Some noise looks very similar to PD. With the increasing use of power electronic components, these pulses can be ever-present in industrial environments.

With freely-selectable filtering options, the MPD 600 can be flexibly adapted to challenging on-site conditions. This results in a maximal signal-to-noise ratio.

## Manual Gating

An unlimited number of phase/amplitude gates allows the MPD 600 to suppress signals with a certain amplitude and fixed phase position (e.g. converter pulses, drives, irrelevant PD). The gating areas are easy to define by marking them with the mouse.

## Antenna Gating

To eliminate the effect of disturbances (e.g. corona) to the measurement results, an optional external MPD 600 can be used as unit gate (Antenna Gating).

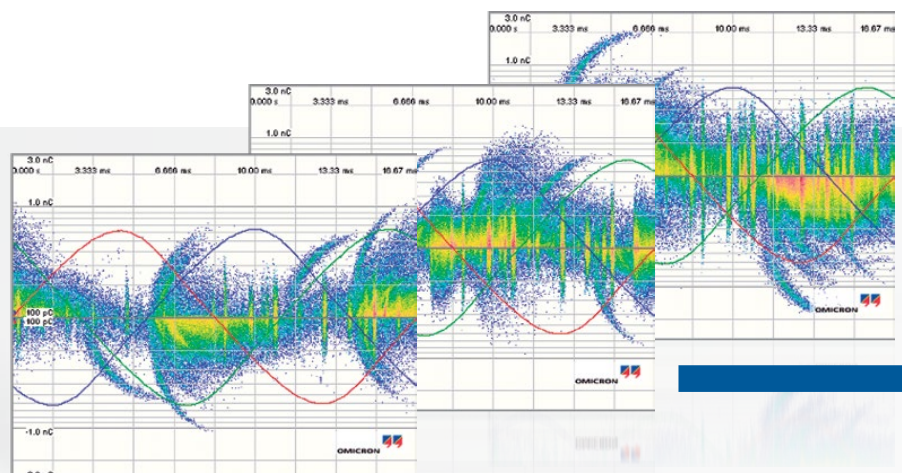
## Dynamic Noise Gating (DyNG)

Non-stationary pulses that are not fixed in phase ("moving" vs. phase) – e.g. interference from drives, motor-generator test sets and temporary interference – can be suppressed by the unique Dynamic Noise Gating. The amplitude-phase window follows the disturbance pulses regularly.

## Advanced noise separation tools

PD events on one phase can be detected also on the other phases. Distinction between different PD sources and superimposed noise pulses is a challenge due to this coupling.

The MPD 600 provides powerful tools for separation of different sources of interference and easy visualization.



PD diagrams of three phases, partially superimposed or with interference signals



### 3-phase amplitude relation diagram (3PARD)

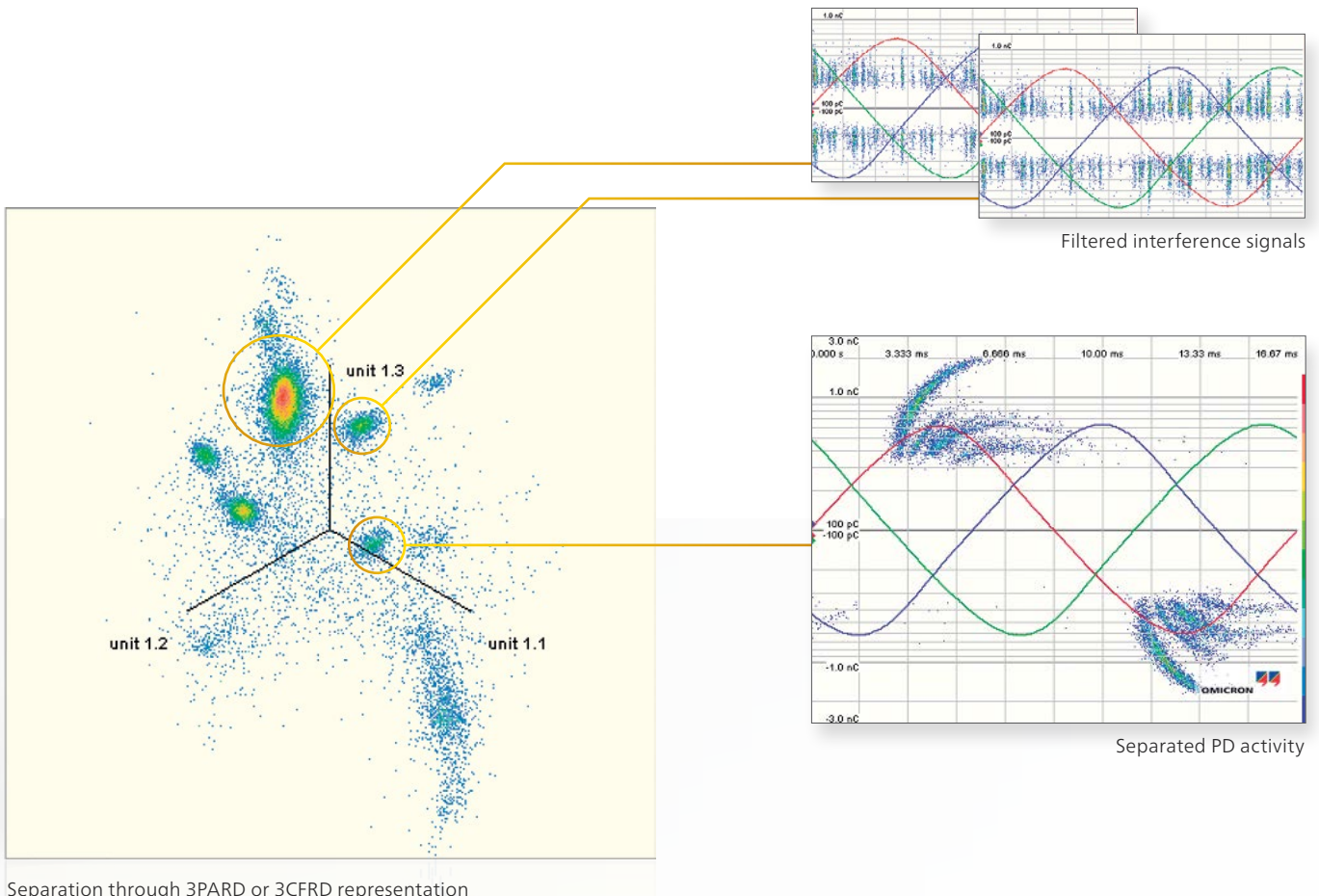
The 3PARD simplifies the differentiation of various PD sources and PD interferences. The three phases are measured synchronously and the results can be displayed combined in a single diagram, the 3PARD diagram.

This enables results to be easily compared and PD sources can be quickly selected in the star diagram. This can result in significant cost savings, for example when screening measures can be reduced.

### Synchronous multi-frequency measurements (3FREQ)

The 3FREQ characterizes PD sources by their frequency signature. Even for a single phase, or a single PD decoupling position, pulse triples can be acquired by using three different PD filter settings.

The synchronous signal output from three filters with different center frequencies is visualized in a 3-Center Frequency Relation Diagram (3CFRD) for pulse waveform analysis.



Separation through 3PARD or 3CFRD representation

# Post processing of realtime data

In many cases there is insufficient time for further detailed analysis of the PD patterns or the changes which occurred during testing.

The MPD 600 can store PD events with very high sampling rate during testing. In addition, the test voltages and all other relevant system settings are stored.

This creates a growing database, which can be used as reference for the interpretation of future measurement results.

Numerous functions are integrated into the MPD 600 system for safe and easy handling of the measured data.

## Replay function

By storing the measured data as unprocessed raw data, it can still be analyzed subsequently. The full set of analysis functions and the different tools like 3PARD or gating can be used for this – just as if the measurement was performed once again.

## Streaming function

The recorded measured data, or so-called streams, can be cut individually, i.e. to focus on relevant PD events. As the playback speed can also be freely selected, some sections can be played back more slowly and thus be analyzed in greater detail.

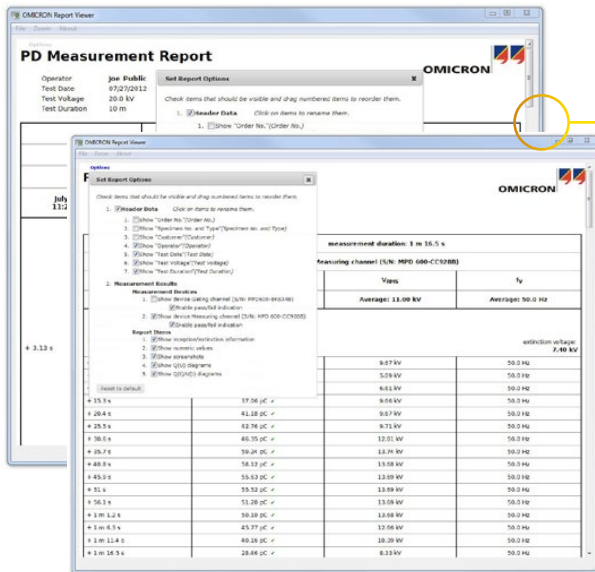
## Export function

Recordings can also be stored as video in .avi format. With the compressed file size, the videos are easier to handle, need less storage space and can be sent to experts for further analysis as an email attachment. In addition, the videos can be played back without the installed MPD software.



## External application interface

A flexible application interface, based on Microsoft COM®, allows the complete transfer of all measured quantities and configuration settings to other programs like Microsoft Excel™ or MATLAB®. Application-specific software solutions can thus be realized without problems.



### Integrated reporting

Clear reports can be created automatically in .xml format. A company logo can be easily integrated.

Furthermore, screenshots can be added to the report at any time at the touch of a button. The reports can also be stored as PDF file. This basic version for reporting is included in all software packages free of charge.



### Individual protocol generator

The protocol generator integrated into Microsoft Excel™ supports significantly more functions. It controls the MPD 600 application and integrates all measurement functions into an individually adapted, ready-to-print protocol.

All measured values can be integrated as clear diagrams or tables in the report with just a few clicks. A screenshot of the PD pattern can be integrated at the touch of a button.

# Applications and software packages



## Multi-channel measurements of power transformers

The MPD 600 quickly measures all of the relevant quantities for a reliable PD measurement of power transformers. No matter whether it affects a single or three-phase transformer.



## Localizing PD failures accurate to a meter

Fault-finding in cables with the MPD 600 provides accuracy better than 0.2 % of the total cable length. PD faults can thus be localized with meter to centimeter precision. During commissioning, the MPD 600 can also be used for quality control of cable accessories, such as joints and terminations.



## Reliable assessment of rotating machines

Rotating machines, industrial drives and railway transportation must be assessed offline or in operation. With the help of the MPD 600 and its unique functions, the difficulties of nearby interfering fields can be overcome much easier than other systems.



## Precise assessment in factories and laboratories

In shielded laboratories, PD measurements on high-voltage components are carried out using coupling capacitors and measuring impedances. After calibration, the MPD shows the apparent charge according to IEC 60270. PD analysis is supported by graphical tools such as the PRPD pattern.



## PD measurements on gas-insulated switchgear (GIS)

PD measurements within the ultra-high frequency range are very sensitive and have therefore been employed for PD detection in a long time. In new plants, UHF sensors are more and more integrated – alternatively, mobile and external sensors can be used. The combination of MPD 600 and OMICRON's UHF 620 allows fast and easy PD measuring up to the UHF range and provides different frequency bandwidths.



|                                       |  | Basic Package<br>included | Advanced Package<br>VESM4101 | Cable Package<br>VESM4102 |
|---------------------------------------|--|---------------------------|------------------------------|---------------------------|
| Measurement and visualization         | Multiple bandwidths with freely selectable measurement frequencies   | ■                         | ■                            | ■                         |
|                                       | Recording and replaying stream files   | ■                         | ■                            | ■                         |
|                                       | Software support for RIV measurements  | ■                         | ■                            | ■                         |
|                                       | Oscilloscope and spectrum analyzer function  | ■                         | ■                            | ■                         |
|                                       | Phase-resolved PD pattern (PRPD), ellipse visualizations and individual PD events  | ■                         | ■                            | ■                         |
|                                       | 3D histogram visualizations  | ■                         | ■                            | ■                         |
|                                       | Voltage curve visualization  | ■                         | ■                            | ■                         |
|                                       | Q(U) and H(Q) Diagram  | –                         | ■                            | –                         |
|                                       | Trending   | –                         | ■                            | –                         |
|                                       | DC measurements  | –                         | ■                            | –                         |
|                                       | Additional statistic values in accordance with IEC 60270   | –                         | ■                            | –                         |
| Triggering                            | Light-sensitive sensor triggers the histogram  | ■                         | ■                            | ■                         |
|                                       | Every MPD unit triggers itself   | ■                         | ■                            | ■                         |
|                                       | Internal triggering if no artificial light source is available   | ■                         | ■                            | ■                         |
| Cable testing                         | Cable fault locating mode using TDR, statistical TDR and dual-end method   | –                         | ■                            | ■                         |
|                                       | Guided cable assessment user interface ( <a href="#">Cable Mode</a> )  | –                         | –                            | ■                         |
| Gating and noise suppression          | Phase and phase-amplitude gating   | ■                         | ■                            | ■                         |
|                                       | Unit gating (Antenna Gating)   | ■                         | ■                            | ■                         |
|                                       | Dynamic Noise Gating (DyNG)  | –                         | ■                            | –                         |
|                                       | 3PARD multi-phase measurements   | –                         | ■                            | –                         |
|                                       | <a href="#">3FREQ Module<sup>1</sup> – VESM4104</a><br>> 3FREQ multi-frequency measurements and 3CFRD visualization                              | –                         | □                            | □                         |
| Generating reports and exporting data | Generating XML reports   | ■                         | ■                            | ■                         |
|                                       | Exporting data into MATLAB® files  | –                         | ■                            | –                         |
|                                       | <a href="#">Report Module – VESM4103</a>   | □                         | □                            | □                         |
|                                       | > Automated, Microsoft Excel™-based report generation  |                           |                              |                           |
|                                       | > Automation via Microsoft COM® interface ( <a href="#">Integration Module – VESM4108</a> )<br>> Voltage and PD values for external applications |                           |                              |                           |

<sup>1</sup> Only available with "Advanced Package"

■ included    □ optional    – not included

# Measurement setup and ordering information

## MPD packages

### MPD 600 one-channel package

- 1 × MPD 600 acquisition unit
- 1 × MCU 502 controller
- 1 × CPL 542 0.5 A impedance
- 1 × Fiber optical cable, 20 m / 66 ft
- 1 × MPP 600 power supply package
- + software package "Basic Package"

### MPD 600 one-channel basic equipment

- 1 × MPD 600 acquisition unit
- 1 × MCU 502 controller
- 1 × MPP 600 power supply package
- + software package "Basic Package"

Note: Similar to MPD 600 one-channel package (VE004110) but without CPL 542 and fiber optical cable.

### MPD 600 three-channel package

- 3 × MPD 600 acquisition unit
- 1 × MCU 502 controller
- 3 × CPL 542 0.5 A impedance
- 3 × Fiber optical cable, 20 m / 66 ft
- 3 × MPP 600 power supply package
- + software package "Basic Package"

### MPD 600 three-channel basic equipment

- 3 × MPD 600 acquisition unit
- 1 × MCU 502 controller
- 3 × MPP 600 power supply package
- + software package "Basic Package"

Note: Similar to MPD 600 three-channel package (VE004130) but without CPL 542 and fiber optical cable.

### MPD 600 gating channel package

- 1 × MPD 600G
- 1 × Fiber optical cable, 20 m / 66 ft
- 1 × MPP 600 power supply package

### MPD 600 single-channel extension package

- 1 × MPD 600 acquisition unit
- 1 × CPL 542 0.5 A impedance
- 1 × MPP 600 power supply package
- 1 × Fiber optical cable, 20 m / 66 ft

## Order no.

VE004110

VE004116

VE004130

VE004133

VE004120

VE004111

## MPD packages

### MPD 600 / MBB1 measurement balanced bridge package

- 1x MPD 600 acquisition unit
- 1x MCU 502 controller
- 1x MPP 600 power supply package
- 1x Fiber optical cables, 20m / 66ft
- 1x MBB1 for differential PD measurements
- 2x CPL 542 0.5A impedance
- 1x CAL 542-Type D (for bridge adjustment)
- + MPD software "Basic Package" and MBB1 software (64-bit only)

## Order no.

VE004136

## MPD software

## Order no.

### 1 Software packages/modules

|                           |          |
|---------------------------|----------|
| Basic Package             | Included |
| Advanced Package          | VESM4101 |
| Cable Package             | VESM4102 |
| Report Module             | VESM4103 |
| 3FREQ Module <sup>1</sup> | VESM4104 |
| Integration Module        | VESM4108 |

<sup>1</sup> Only available with "Advanced Package"

## Miscellaneous components

## Order no.

### 2 Fiber optical bus controller

|                                     |          |
|-------------------------------------|----------|
| MCU 502: Bus controller for MPD 600 | VE004300 |
|-------------------------------------|----------|

### 3 Duplex fiber optical cables

|   |          |
|---|----------|
| Duplex fiber optical cable, 3 m / 10 ft   | VEHK4003 |
| Duplex fiber optical cable, 20 m / 65 ft  | VEHK4001 |
| Duplex fiber optical cable, 50 m / 165 ft | VEHK4002 |

### 4 Lithium-ion battery

|   |          |
|---|----------|
| MPP 600 power supply package (consisting of battery, fastener, and charger with power cord) | VEHZ4105 |
| MPP 600 lithium-ion battery   | VEHZ4106 |

## Protection cases

|                         |          |
|-------------------------|----------|
| MPC 600 protection case | VEHP0041 |
|-------------------------|----------|

## Transport cases

|  |          |
|--|----------|
| MBT 600 transport case (for a complete 4-channel MPD system) | VEHP0045 |
| Flight case for MPD  | VEHP0048 |

## MPD 600 system setup



1 Software

2 MCU 502



14

3 Duplex fiber optical cable



4 MPD 600 and MPP 600



## Accessories

## Order no.

### 1 Charge calibrators/injectors

|          |                               |          |
|----------|-------------------------------|----------|
| CAL 542: | Version A (0.1 pC ... 10 pC)  | VE004200 |
| CAL 542: | Version B (1 pC ... 100 pC)   | VE004210 |
| CAL 542: | Version C (10 pC ... 1000 pC) | VE004220 |
| CAL 542: | Version D (0.1 nC ... 10 nC)  | VE004230 |

### 2 Calibrators for RIV measurements

|             |   |          |
|-------------|---|----------|
| RIV1-NEMA:  | Output impedance = $< 2 \Omega$         | VE004250 |
| RIV1-CISPR: | Output impedance = $20 \text{ k}\Omega$ | VE004251 |

### 3 Measurement balanced bridge

|      |  |          |
|------|--|----------|
| MBB1 | Basic version                                  | VEHZ4149 |
| MBB1 | Extended version (incl. CAL 542-D and CPL 542) | VEHZ4155 |

### 4 Measuring impedances

|          |                  |          |
|----------|------------------|----------|
| CPL 542: | 0.5 A type       | VEHZ4100 |
| CPL 542: | 2 A type         | VEHZ4101 |
| CPL 543: | 5 A type         | VEHZ4103 |
| CPL 542: | NEMA 0.5 A type  | VEHZ4150 |
| CPL 542: | NEMA 1.2 A type  | VEHZ4151 |
| CPL 542: | CISPR 0.5 A type | VEHZ4152 |
| CPL 542: | CISPR 1.2 A type | VEHZ4153 |

### 5 Coupling capacitors<sup>2</sup>

|            |   |          |
|------------|---|----------|
| MCC 112:   | 12 kV, 1.2 nF   | VEHZ4118 |
| MCC 117-C: | 17.5 kV, 2 nF (with $2\mu\text{F}$ low arm capacitor) | VEHZ4157 |
| MCC 124-C: | 24 kV, 1.0 nF (with $2\mu\text{F}$ low arm capacitor) | VEHZ4158 |
| MCC 210:   | 100 kV, 1.0 nF (on mobile base) <sup>3</sup>          | VEHZ4117 |
| MCC 210L:  | 100 kV, 1.0 nF (on mobile base)                       | VEHZ4126 |

## Accessories

## Order no.

### 6 Bushing adapters<sup>2</sup>

|           |  |          |
|-----------|--|----------|
| BTA3 kit  | G $\frac{3}{4}$ " inside, 4 mm female                      | VEHZ4162 |
| BTA6 kit  | 2 $\frac{1}{4}$ " – 12 UN outside, 8 mm female             | VEHZ4163 |
| BTA7 kit  | M30 x 1.5 outside, 4 mm female                             | VEHZ4164 |
| BTA9 kit  | $\frac{3}{4}$ " –14 NPSM outside, spring contact interface | VEHZ4165 |
| BTA14 kit | M24 inside, 4 mm male                                      | VEHZ4166 |

### 7 High frequency current transformer

|         |          |
|---------|----------|
| MCT 120 | VEHZ4148 |
|---------|----------|

### 8 Bandwidth converter

|         |          |
|---------|----------|
| UHF 620 | VEHZ4137 |
|---------|----------|

### 9 Pulse generator

|         |          |
|---------|----------|
| UPG 620 | VE004242 |
|---------|----------|

### 10 UHF valve sensor

|                            |          |
|----------------------------|----------|
| UVS 610 (incl. carry case) | VEHZ4131 |
|----------------------------|----------|

### 11 Hatch-type UHF sensor

|      |          |
|------|----------|
| UHT1 | VMON0194 |
|------|----------|

### 12 UHF cable sensor

|      |          |
|------|----------|
| UCS1 | VEHZ4144 |
|------|----------|

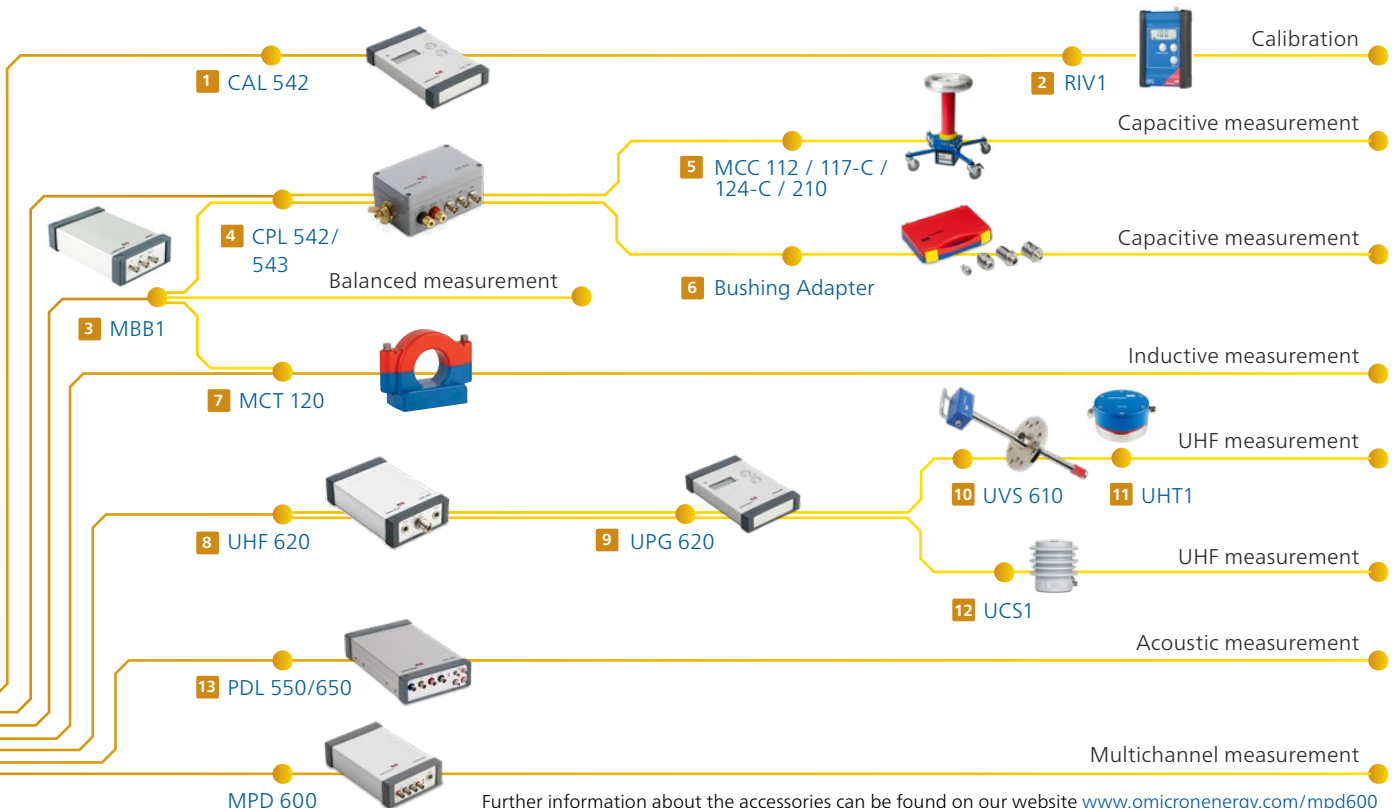
### 13 Acoustic PD locator

|                                     |          |
|-------------------------------------|----------|
| PDL 650 (without sensors)           | VEHZ4132 |
| Kit of 4 x AES 075 sensors (75 kHz) | VEHZ4133 |
| Kit of 4 x DT151 sensors (150 kHz)  | VEHZ4134 |

<sup>2</sup> Customized articles available on request

<sup>3</sup> Includes CPL measuring impedance

Application areas with accessories



Further information about the accessories can be found on our website [www.omicronenergy.com/mpd600](http://www.omicronenergy.com/mpd600)

# Technical data

## MPD 600



### Input

|                            |   |
|----------------------------|---|
| Center frequency           | 0 Hz ... 32 MHz   |
| Frequency domain bandwidth | Standard: 9 kHz, 40 kHz, 100 kHz, 160 kHz, 300 kHz, 650 kHz, 1 MHz, 1.5 MHz<br>With broadband filter: 9 kHz, 30 kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz |
| Time domain                | 100 ns ... 8 $\mu$ s  |
| Input frequency range      | V input: DC, 0.1 Hz ... 2.16 kHz<br>PD input: 0 Hz ... 20 MHz   |
| Input impedance            | V input: 1 M $\Omega$ (parallel 1 $\mu$ F)<br>PD input: 50 $\Omega$   |
| Input voltage              | V input: 60 V rms (max.)<br>PD input: 10 V rms (max.)   |
| Dynamic range              | V input: 102 dB<br>PD input: 132 dB (overall), 70 dB (per input)  |

### PC Requirements

|               |  |
|---------------|--|
| Min. hardware | Pentium 4® / Athlon 64® or better, 1 GB RAM, USB 2.0 |
| Software      | Windows 7™, Windows 8™, Windows 8.1™, Windows 10™    |

### Exactitude

|                              |   |
|------------------------------|---|
| PD event time resolution     | < 2 ns  |
| System noise                 | < 0.015 pC  |
| Spectrum analyzer noise      | < -120 dB   |
| Max. double pulse resolution | < 200 ns (time domain integration, superposition error < 1 %)   |
| Measurement accuracy         | Voltage: $\pm$ 0.05 % of calibrated V value<br>Frequency: $\pm$ 1 ppm (typical)<br>PD level: $\pm$ 2 % of calibrated PD value |

### Dimensions and Ambient Condition

|                                |   |
|--------------------------------|---|
| Humidity                       | 5 % ... 95 %, non-condensing  |
| Ambient temperature            | Operation: 0 °C ... 55 °C / 32 °F ... 89 °F<br>Storage: -10 °C ... 70 °C / 14 °F ... 158 °F               |
| Power supply (MPP 600 package) | 8 V DC ... 12,4 V DC<br>(external charger input range: 110 V ... 240 V, 50 Hz ... 60 Hz and battery pack) |
| Dimensions (W x H x D)         | 110 x 44 x 190 mm / 4.3 x 1.7 x 7.5 in  |
| Weight                         | 600 g / 1.3 lb  |

## MCU Fiber Optic Bus Controller



### Technical Data

|                                      |  |
|--------------------------------------|--|
| Dimensions (W x H x D)               | 110 x 30 x 180 mm / 4.3 x 1.2 x 7.1 in |
| Weight                               | 590 g / 1.3 lb                         |
| Connectors                           |  |
| USB 2.0 type B (with USB cable, 2 m) | 1 x                                    |
| Fiber optical network (600 series) * | 2 x                                    |

\* 600 series: 2 ST connectors; suitable for MPD 500/600

## MPP 600 – Lithium-Ion Power Pack with Battery Charger



### Technical Data

|                        |  |
|------------------------|--|
| Dimensions (W x H x D) | 110 x 30 x 170 mm / 4.3 x 1.2 x 6.7 in |
| Weight                 | 780 g / 1.719 lb                       |
| Power Rating           | 11.1 V nominal, 8.7 Ah                 |
| Nominal energy         | 96.5 Wh                                |



## 1 CAL – Charge calibrator/injector



The CAL 542 charge calibrator is used to inject a defined charge into and verify the measurement circuit.

| Technical Data             | CAL 542  |
|----------------------------|--|
| Pulse repetition frequency | 300 Hz   |
| Pulse rise time            | < 4 ns*  |
| Dimensions (W x H x D)     | 110 x 30 x 185 mm / 4.3 x 1.2 x 7.3 in                   |
| Weight (incl. battery)     | 520 g / 1.2 lb   |
| Output connector           | 1 x BNC (with BNC adapter, cables and connection clamps) |
| Power supply               | Lithium Battery 9 V, Lifetime > 10 years                 |

\* Typical value for version A and version B

## 2 RIV1 – RIV Test calibrator



The RIV1 calibrator enables the reliable calibration of the MPD system for PD measurement based on Radio Influence Voltage (RIV) according to NEMA and CISPR standards.

| Technical Data         | RIV1-NEMA                                 | RIV1-CISPR                               |
|------------------------|---|--|
| Frequency range        | 100 kHz ... 2 MHz (50 kHz steps)          | 100 kHz ... 2 MHz (50 kHz steps)         |
| Magnitude              | 10 µV ... 10 mV                           | 10 µV ... 10 mV @300 Ω                   |
| Magnitude Accuracy     | <2%                                       | <2%                                      |
| Output Impedance       | <2 Ohm                                    | 20 kOhm                                  |
| Standards met          | NEMA 107 - 1987, IEEE C57.12.90-2008      | IEC 60437, CISPR 18-2 (2)                |
| Accessory (Quadripole) | CPL 542 NEMA 0.5 A, CPL 542 NEMA 1.2 A    | CPL 542 CISPR 0.5 A, CPL 542 CISPR 1.2 A |
| Connectors             | 1 x BNC                                   |  |
| Dimensions (W x H x D) | 120 x 40 x 183 mm / 4.72 x 1.57 x 7.20 in |  |
| Weight                 | 680 g / 1.5 lb                            |  |
| Material               | Extruded aluminum                         |  |
| Operating temperature  | 0 °C ... 50 °C / -4 °F ... 122 °F         |  |
| Storage temperature    | -20 °C ... 70 °C / 14°F ... 158 °F        |  |
| Humidity               | 10 ... 95 %, non-condensing               |  |

## 3 MBB1 – Measurement bridge



The MBB1 is a measurement balanced bridge used to obtain reliable partial discharge (PD) measurements in test environments with heavy interference. It enables you to perform differential PD measurements as recommended by IEC 60270.

| Technical Data            |   |
|---------------------------|---|
| Frequency range           | 100 kHz ... 1 MHz                         |
| Maximum voltage input     | 60 V <sub>rms</sub>                       |
| Maximum PD voltage inputs | 10 V <sub>rms</sub>                       |
| Input connections         | 3 x BNC (PD-1, PD-2, V)                   |
| Output connections        | 2 x BNC (PD, V)                           |
| Control and power supply  | via AUX-connection to MPD 600             |
| Dimensions (W x H x D)    | 110 x 190 x 44 mm / 4.33 x 7.48 x 1.73 in |
| Weight                    | 650 g / 1.4 lb                            |

## 4 CPL – Measuring impedance



The CPL quadripoles are external measuring impedances for partial discharge measurements. Both include an integrated 90 V<sub>Peak</sub> overvoltage protection device.

| Technical Data              | CPL 542  | CPL 543                        |
|-----------------------------|--|--------------------------------|
| Max. currents               | 0.5 A or 1.2 A / 2 A                                 | 5 A                            |
| Frequency range (PD output) | 20 kHz ... 5 MHz (CISPR)<br>0.85 ... 1.15 MHz (NEMA) | 29 kHz ... 5 MHz               |
| Low-arm capacitance         | 30 µF (for 0.5 A)<br>120 µF (for 2 A or 1.2 A)       | 272 µF                         |
| Input connectors            | 2 x 4 mm terminal*<br>1 x GND                        | 2 x 4 mm terminals*<br>1 x GND |
| Output connectors           | 2 x BNC (PD & V),<br>1 x BNC (TTL signal)            | 2 x BNC (PD & V)               |

| Mechanical Data        |  |  |
|------------------------|--|--|
| Dimensions (W x H x D) | 150 x 60 x 100 mm / 5.9 x 2.4 x 4.0 in | 150 x 60 x 100 mm / 5.9 x 2.4 x 4.0 in |
| Weight                 | 700 g / 1.5 lb                         | 700 g / 1.5 lb                         |

\* For connecting coupling capacitor

# Technical data



## 5 MCC – Coupling capacitor

The coupling capacitor connects the MPD 600 to the high-voltage test object. Different MCC coupling capacitors are available for various voltage levels. The MCC 112, MCC 117-C and MCC 124-C coupling capacitors are designed for direct connection to the MPD 600. The MCC 210 is designed with a built-in quadripole measuring impedance with 4 µF low-arm capacitance. The MCC 210L is available without the quadripole.

| Technical Data              | MCC 112                                      | MCC 117-C                                    | MCC 124-C   | MCC 210 / MCC 210L                             |
|-----------------------------|--|--|---|--|
| $U_{pr8}$ (phase-to-ground) | 12 kV  | 17.5 kV                                      | 24 kV   | 100 kV   |
| $C_{Nominal}$               | 1.2 nF ( $\pm 20\%$ )                        | 2 nF (+/- 15%)                               | 1.2 nF (+/- 20%)<br>Option C: 1.0 nF (+/- 15%)  | 1.0 nF ( $\pm 10\%$ )                          |
| Withstand Voltage (1 min)   | 28 kV  | 38 kV  | 50 kV   | 120 kV   |
| $Q_{PD}$                    | < 2 pC @ 13.2kV                              | < 2 pC @ 20.7 kV                             | < 2 pC @ 26.4 kV  | < 1 pC @ 100 kV                                |
| Weight                      | 4.5 kg / 9.9 lb                              | 2.3 kg / 5.1 lb                              | 6 kg / 13.2 lb<br>Option C: 3.2 kg / 7.05 lb  | 10 kg / 22.1 lb                                |
| Dimensions (W x H x D)      | 182 x 158 x 182 mm /<br>7.2 x 6.2 x 7.2 in   | 104 x 150 x 165 mm /<br>4.1 x 5.9 x 6.5 in   | 182 x 238 x 182 mm /<br>7.2 x 9.4 x 7.2 in<br>Option C:<br>150 x 219 x 150 mm /<br>5.9 x 8.6 x 5.9 in | 450 x 766 x 450 mm /<br>17.5 x 30.15 x 17.5 in |
| Scope of delivery           | Adapter (TNC to BNC)<br>BNC connection cable | Adapter (TNC to BNC)<br>BNC connection cable | Adapter (TNC to BNC)<br>BNC connection cable  | BNC connection cable                           |

## 6 Bushing adapters



The following BTA kits consist of a BTA adapter that connects to the specific measurement tab and includes a gas discharge tube. The kits also include a BTA to BNC adapter and a coaxial cable that connects either via CPL or directly to the MPD system.

| Technical Data |   |
|----------------|---|
| BTA3 kit       | G 3/4" inside thread, 4mm female connector for:<br>e.g. ABB / Micafil standard, RTKF, RTKG                      |
| BTA6 kit       | 2 1/4" – 12 UN outside thread, 8mm female connector for:<br>IEEE Standard bushing measurement tab, ABB O Plus C |
| BTA7 kit       | M30 x 1.5 outside thread, 4mm female connector for:<br>e.g. HSP Type SETF                                       |
| BTA9 kit       | 3/4" – 14 NPSM outside thread, spring contact interface for:<br>e.g. ABB Type T                                 |
| BTA14 kit      | M24 inside thread, 4 mm male connector for:<br>e.g. F&G or HSP Type EKTF  |

## 7 MCT 120 – High frequency CT



The MCT 120 is a high-frequency current transformer (HFCT), which picks up partial discharge signals in moderate heights and at a safe distance from high-voltage.

| Technical Data          |  |
|-------------------------|--|
| Frequency Range (-6 dB) | 80 kHz ... 40 MHz (0 mm gap)                 |
| Inner hole dimensions   | ø ~53.5 mm / 2.11 in                         |
| Outer dimensions        | 114 x 154 x 62 mm /<br>4.49 x 6.07 x 2.45 in |
| Ferrite core            | Split  |
| Connector               | BNC, 50 Ohm, female                          |
| Weight                  | 1.2 kg / 2.65 lb                             |
| Operating temperature   | -20 °C ... 55 °C / -4 °F ... 130 °F          |

## 8 UHF 620 – Bandwidth converter



The bandwidth converter extends the measuring frequency range up to the VHF/UHF range and makes the detection of partial discharge more sensitive. This is ideal e.g. for measuring power transformers and gas-insulated substations (GIS).

| Technical Data                 |   |
|--------------------------------|---|
| UHF input range fc             | 100 MHz ... 2.000 MHz<br>(adjustable in 500 kHz steps)                      |
| Measuring bandwidth Δf         | Narrowband: Up to 1.5 MHz<br>Mediumband: At 70 MHz<br>Broadband: At 1.9 GHz |
| Impedance UHF input            | 50 Ω (N-type input jack)  |
| RF pre-amplifier               | 20 dB amplifier, switchable   |
| Synchronization via UHF sensor | 10 ... 100 Hz<br>(test voltage frequency)                                   |

| Mechanical Data        |   |
|------------------------|---|
| Power supply           | Via AUX-connector of MPD 600 and battery pack MPP 600 |
| Weight                 | 700 g / 1.5 lbs                                       |
| Dimensions (W x H x D) | 110 x 44 x 190 mm /<br>4.3 x 1.7 x 7.5 in             |
| Operating temperature  | 0 °C ... 55 °C / 35 °F ... 130 °F                     |
| Relative humidity      | 5 ... 95 %, non-condensing                            |

## 9 UPG 620 – Pulse generator



The UPG 620 generates very fast slope pulses and is mainly used to verify the measurement circuit in the UHF range.

### Technical Data

|                           |   |
|---------------------------|---|
| Rise time                 | < 200 ps  |
| Decay time                | > 100 ns  |
| Frequency repetition rate | 100 Hz  |
| Power supply              | 2 x 9 V lithium battery for<br>> 120 h continuous operation |
| Weight                    | 700 g / 1.5 lb  |
| Dimensions (W x H x D)    | 110 x 28 x 185 mm /<br>4.3 x 1.1 x 7.3. in                  |
| Operating temperature     | 0 °C ... 55 °C / 35 °F ... 130 °F                           |

## 10 UVS 610 – UHF valve sensor



The UHF valve sensor allows partial discharge measurements in high-frequency ranges in power transformers with liquid insulation. It is inserted through the oil drain valve (DN 50 and DN 80).

### Technical Data

|                        |   |
|------------------------|---|
| Usabel frequency range | 150 MHz ... 1 GHz   |
| Tightness              | up to 5 bar pressure<br>-15 °C ... 120 °C / 5 °F ... 248 °F |
| Insertion depth        | 55 mm ... 450 mm / 2.2 in ... 17.7 in                       |
| Weight                 | 3.1 kg / 6.8 lb   |
| Dimensions (Ø x H)     | 200 x 610 mm / 7.9 x 24 in                                  |

## 11 UHT1 – Hatch-type UHF sensor



The UHT1 is a hatch-type sensor used for detecting PD inside power transformers in the ultra-high frequency (UHF) range. It is installed permanently on the surface of a tank of oil-paper-insulated power transformers, which do not have oil drain valve for an UVS 610.

### Technical Data

|                       |  |
|-----------------------|--|
| Frequency range       | 200 MHz ... 1 GHz  |
| Leakage tightness     | For oil temperatures of -15 °C ... +120 °C /<br>5 °F ... +248 °F at 5 bar pressure |
| Operating temperature | -15 °C ... +120 °C / 5 °F ... +248 °F  |
| Storage temperature   | -15 °C ... +70 °C / 5 °F ... +158 °F   |
| Humidity              | 5 % ... 95 % (non-condensing)  |
| Dimensions (Ø x h)    | 150 x 109 mm / 5.91 x 4.29 in  |
| Insertion depth       | 28 mm / 1.10 inch from flange to<br>oil barrier                                    |
| Weight                | 5 kg / 11.02 lb  |
| UHF (output)          | Coaxial RF connector (TNC socket)  |
| TEST (input)          | Coaxial RF connector (type N socket)   |

## 12 UCS1 – UHF cable sensor



This sensor performs partial discharge measurements in UHF ranges in grounding systems of high-voltage cables and cable terminations.

### Technical Data

|                       |                                     |
|-----------------------|-------------------------------------|
| Frequency range       | 100 MHz ... 1000 MHz                |
| Capacitance           | 2 nF                                |
| Insulation level      | 12 kV                               |
| AC withstand voltage  | 28 kV; 1 min                        |
| Operating temperature | -20 °C ... 85 °C / -4 °F ... 185 °F |
| Dimensions (Ø x H)    | 105 x 107 mm / 4.1 x 4.2 in         |
| Weight                | 1.2 kg / 2.6 lb                     |
| Primary connections   | Screw thread 2x M8x14               |
| Connector             | TNC                                 |

## 13 PDL 650 – Acoustic PD locator



The PDL 650 measures acoustic signals with multiple sensors spread over a power transformer. The software determines the failure location and shows its coordinates in a power transformer 3D model.

### Technical Data

|                       |                                     |
|-----------------------|-------------------------------------|
| Measurement bandwidth | 10 kHz ... 400 kHz                  |
| Amplification         | 0, 20, 36 dB                        |
| Sensors               | Active, supplied via PDL 650        |
| Battery life          | > 4 h                               |
| Mains supply          | 110 V ... 240 V,<br>50 Hz ... 60 Hz |

### Mechanical Data

|                           |  |
|---------------------------|--|
| Dimensions (W x H x D)    | 170 x 61 x 300 mm / 6.7 x 2.4 x 11.8 in  |
| Weight                    | 2.0 kg / 4.5 lbs   |
| Ambient temperature       | Operation: 0 °C ... 45 °C / 32 °F ... 113 °F<br>Storage: -10 °C ... 70 °C / 14 °F ... 158 °F |
| Weight of complete system | < 20 kg / 45 lb<br>(including carry case, cables, etc.)                                      |



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## Welcome to the team

At OMICRON you can always depend on an experienced team that actively supports you and an infrastructure that you can rely on. We always listen attentively in order to understand your needs so that we can offer you the best possible solutions. We strive for lasting partnerships and ensure that you can continue to rely on your product long after you've purchased it. In order to do this, we focus on quality, the transfer of knowledge and unique customer support.

Charles, Wenyu and René are able to tell you about the services we have available for you and why it pays to be part of the team.



Charles Sweetser  
Application Specialist

## Solutions you can rely on...

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Wenyu Guo  
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René Ulmer  
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#### When rapid assistance is required...

... our excellent level of support is always appreciated. You can reach the highly-qualified and committed technicians in our customer support department 24 hours a day, seven days a week – and it's completely free. We deal with repair services and service features in a fair and non-bureaucratic manner.

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# OMICRON – Who we are

## Reliable. Passionate. Different.

For over 30 years we have been developing innovative, top-quality testing and monitoring solutions for electrical power systems.

Customers in more than 160 countries rely on OMICRON's testing technology. In addition, we offer a wide array of services in the fields of consulting, testing and training.

We aim to inspire our customers with exceptional products, an interactive exchange of knowledge and extraordinary customer support. Our curiosity and passion give us the courage to approach things from different angles.

Together with our partners and customers, we are striving towards a safe and reliable energy supply.

*„Create an environment with no artificial limits where a team of excellent members can reach an excellent performance and enjoy working together at the same time.“*

(Rainer Aberer, company founder)

## Our values

We acknowledge our social, ecological and corporate responsibility, and are committed to ensuring sustainable development and business practices. The majority of development and production work takes place at our premises in Austria. Highly specialized suppliers from the region and first-class components guarantee the reliability and durability of every OMICRON device.

Over 750 employees from 45 different countries shape our extremely diverse corporate culture today. Flat hierarchies and a high degree of individual responsibility create a motivational work environment in which our employees can realize their full potential. Actively practiced corporate values such as respect and trust lead to our unique company spirit.

Founding of  
OMICRON in Austria

1984

Entering the fields of protection  
and measurement technology

1990

First major OMICRON  
protection testing conference

1993

OMICRON has  
over 100 employees

2000

Entering the field of  
primary equipment  
testing

2001





The world of OMICRON

OMICRON is an international company that develops, manufactures and markets transformer systems for medium voltage (10 kV) and secondary distribution substations, including monitoring systems and power measurement.

By combining innovation, local expertise, knowledge and international customer support, OMICRON is a leader in its sector.

With more than 70 countries active in customer services, parts and maintenance, and a strong presence of distributors and representatives, OMICRON has truly established a reputation of excellence at the highest level.

Customers in over 100 countries worldwide



Entering the field of online monitoring

Over 700 employees across 22 offices worldwide



2003

2009

2015

OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Customers in more than 150 countries rely on the company's ability to supply leading-edge technology of excellent quality. Service centers on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with our strong network of sales partners is what has made our company a market leader in the electrical power industry.

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.