

# MONTESTO 200

Portable system for temporary on-line partial discharge monitoring and measurement for various electrical assets



# Periodic on-line assessment of insulation condition

## Early defect detection prevents failures

The insulation system of all medium-voltage (MV) and high-voltage (HV) assets is continuously subjected to electrical, thermal, mechanical and environmental stress factors. These cause insulation defects over time, which can eventually lead to dielectric failure and costly outages.

To prevent this from happening, it is important to know the insulation condition of these assets over their entire service life.

## Insulation assessment based on partial discharge

Partial discharge (PD) activity is a reliable indicator of insulation condition, and it is often a sign of insulation defects that can cause failure in electrical assets. That is why it is an important diagnostic parameter used in the factory acceptance testing, commissioning and in-service testing of various MV and HV assets.

## On-line PD monitoring and measurement

Temporary on-line PD monitoring indicates changes in PD activity over specified periods of time during the service life of electrical equipment

On-line PD measurement evaluates PD activity at a given time and offers a snapshot of insulation condition status when the asset is in operation.

The data gathered during temporary on-line PD monitoring and on-line PD measurement enables engineers to determine when electrical equipment is at risk of failure.

This vital condition-based information helps to optimize maintenance strategies, asset management and investment planning.

Observe assets at risk over extended periods of time

Identify assets that require permanent monitoring

Plan maintenance and investment based on asset condition

Clarify asset installation issues within the warranty period

Periodically check asset insulation condition state

Identify assets that require immediate intervention

## Temporary on-line PD monitoring



Motors and generators



Power transformers



Power cables

## On-line PD measurement

## MONTESTO 200 at a glance

MONTESTO 200 is a portable, two-in-one solution for temporary on-line PD monitoring and on-line PD measurement. Designed for both indoor and outdoor use, it performs synchronous, multi-channel PD and voltage data acquisition on various MV and HV electrical assets under load, such as:

- > Motors and generators
- > Power transformers
- > HV cables, terminations and joints

### Plug-and-play connections

MONTESTO 200 can be connected to permanently-installed PD sensors via a terminal box. This allows safe and easy plug-and-play connections while the asset is online to prevent unnecessary downtime during setup.

### Built-in computer

A powerful built-in computer enables continuous on-site data collection and storage. The computer can be remotely accessed and configured by the user to forward periodic reports, alarms and scalar values via universal protocols.

### Convenient web interface

PD monitoring sessions can be quickly set up in less than 10 clicks of a mouse. The collected data can be visualized and analyzed remotely using the software's web interface.

### Online/Offline Delay

The system also determines if the monitored asset is online or offline by comparing the measured  $V_{rms}$  value to the given voltage threshold. Measurement results will not be stored for off-line cables unless specified.

### Alarm notification via email

The system can be configured to send email notifications when user-defined PD thresholds are violated and warnings and alarms are triggered. The system's event log and the corresponding real-time and historical PD data can be instantly viewed via the web interface.

### User-friendly data analysis

Software features, such as 3PAR (3-Phase Amplitude Relation Diagram) and automatic cluster separation, separate noise from PD signals to help users quickly and reliably determine the signal source.

### Customizable, automatic reporting

With optional features, you can customize templates for different types of reports with relevant measurement and alarm data for a specified time period and manage email recipient lists. The reports are automatically generated and distributed as specified.



## Your benefits

- > Two-in-one solution for temporary on-line PD monitoring on-line PD measurement
- > Compact and lightweight for easy transport
- > Designed for indoor and outdoor use
- > Built-in computer for continuous, long-term data collection and archival
- > Web-based interface for convenient remote data access
- > Automated software features for easy data analysis and reporting

 [www.omicronenergy.com/montesto200](http://www.omicronenergy.com/montesto200)

# Front panel features at a glance

A variety of interfaces for data communication: WIFI, LAN, USB, fiber optics, HDMI

Local asset status indication; automatic alarm notification via email (when configured by the user)

Built-in computer for continuous data collection and storage

IP65 rated enclosure designed for indoor and outdoor use

Device handles on both sides

Local Area Network (LAN) connection

Four PD measurement channels

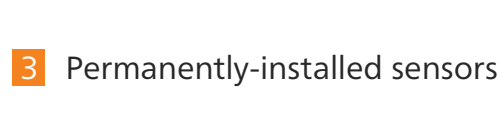




# One solution for on-line PD monitoring and measurement

## Plug-and-play connections

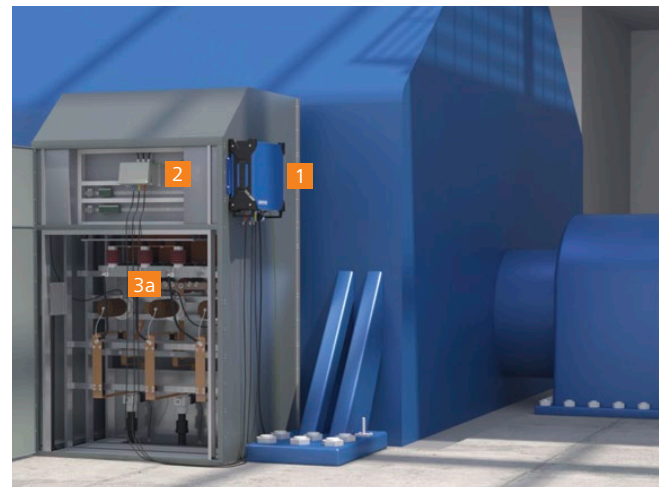
MONTESTO 200 can be easily connected to permanently-installed PD sensors via a terminal box. This enables a safe and convenient plug-and-play set up when electrical assets are on line. As a result, unnecessary downtime can be avoided and the asset can be evaluated under operating conditions.



## Temporary on-line PD monitoring

MONTESTO 200 can also be mounted on or near the asset, connected to permanently-installed PD sensors via the terminal box, and left unattended for PD monitoring. Users can remotely connect to the system anytime with the convenient web interface.

## Motors and generators



## On-line PD measurements

The portable MONTESTO 200 is easy to set up for on-line PD measurements directly at the asset. It can be quickly and safely connected to permanently-installed PD sensors via the terminal box. A portable PC or tablet can be used for measurement setup, viewing live PD data and recording PD data measurement streams for analysis.



**3b** Bushing tap sensors and adapters



**3c** UHF drain valve sensor

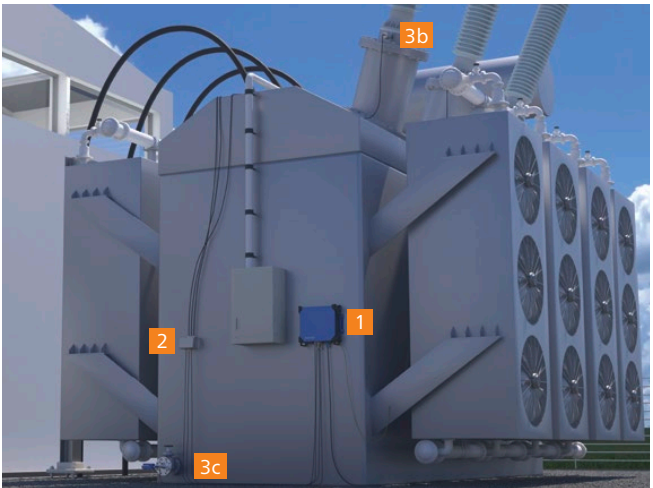


**3d** High-frequency current transformers



Power transformers

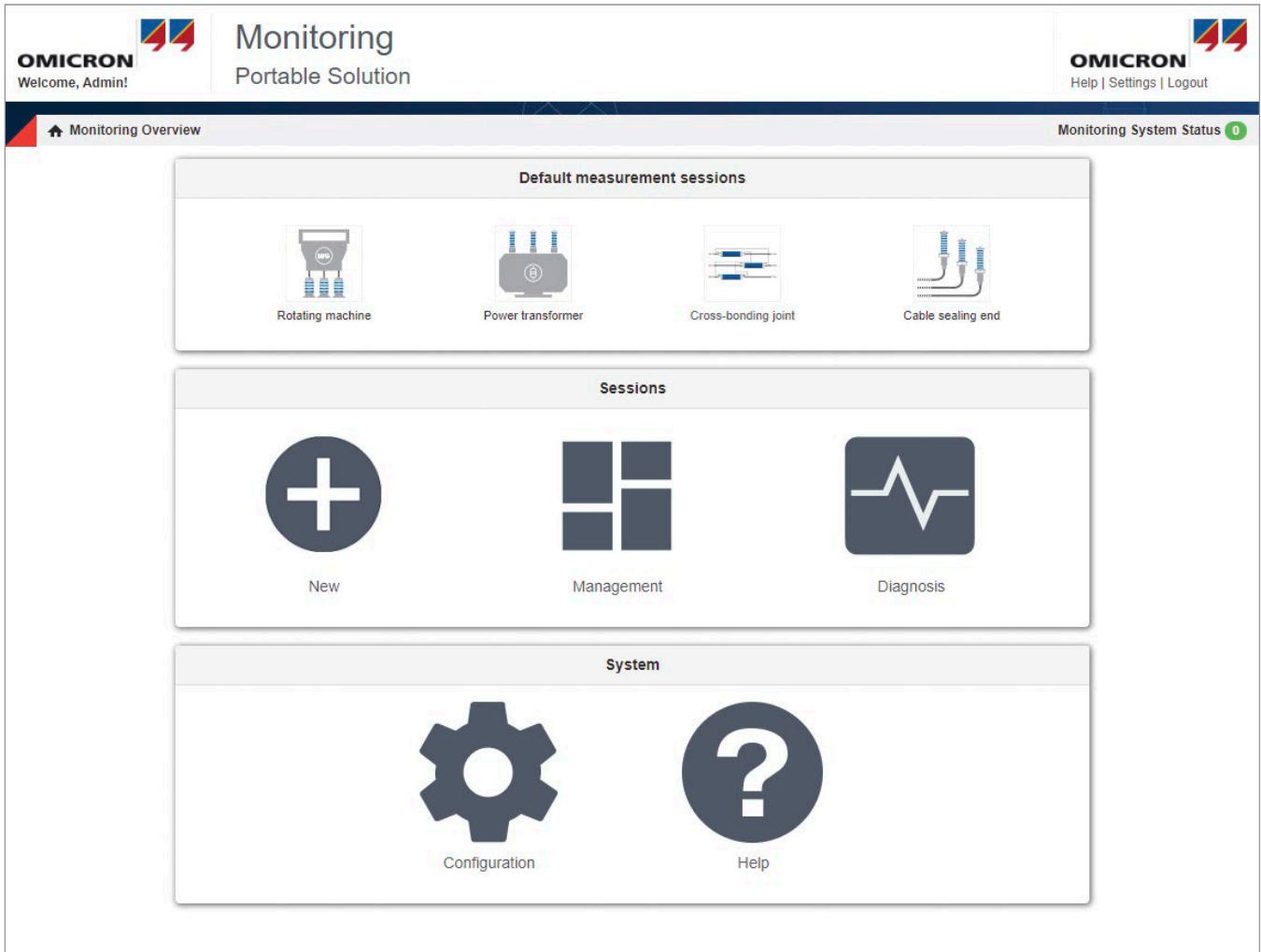
Power cables and accessories



# On-line PD assessments from remote locations

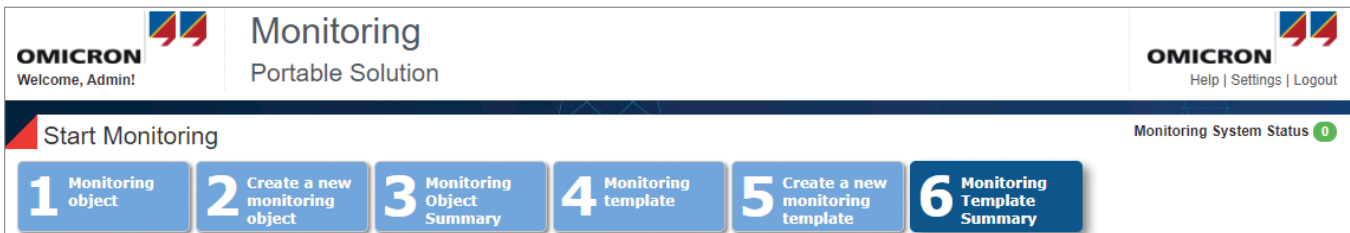
## Convenient web interface

For performing temporary on-line PD monitoring sessions from a remote location, users can set up monitoring sessions as well as view and analyze collected data from anywhere using the MONTESTO 200 software's web interface.



MONTESTO 200 web interface overview screen

## 1 Fast remote monitoring session setup



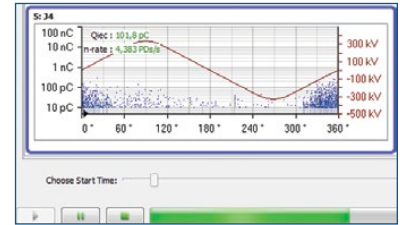
Users can set up and run temporary on-line PD monitoring sessions in six easy steps (less than 10 clicks of a mouse).



## 2 Recording PD data sets

MONTESTO 200 allows the recording of raw PD data sets for detailed analysis. They can be recorded periodically, when triggered by a threshold violation or by the user.

The main measurement values can be stored per channel in a .csv file during replay of a recorded PD Dataset. Using these .csv files, you can perform further analysis and generate charts, for example with MS Excel



## 3 Automatic alarm notification

The system can be configured to send email notifications when measured PD values exceed pre-defined PD thresholds and trigger an alarm.

Supporting data can be viewed anywhere using a smartphone, tablet or PC.



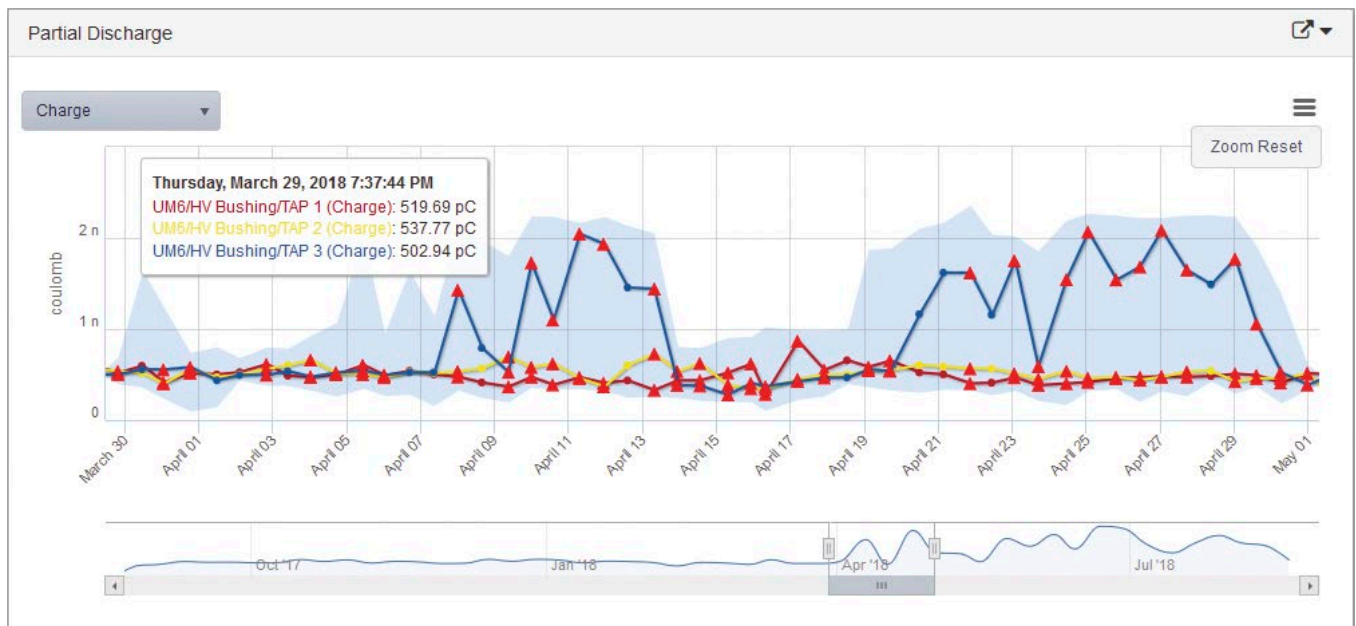
## 4 See triggered warnings and alarms

Event Log - TRAF0 UM6  Show confirmed events

| Start Date ▼      | End Date          | Level ▼  | Source             | Event | Status ▲ |
|-------------------|-------------------|----------|--------------------|-------|----------|
| 8/22/2018 3:14 PM | 8/22/2018 3:15 PM | Critical | HV Bushing / TAP 3 | PD_W  | active   |
| 8/22/2018 3:14 PM | 8/22/2018 3:15 PM | Warning  | HV Bushing / TAP 2 | PD_V  | active   |
| 8/22/2018 3:14 PM | 8/22/2018 3:15 PM | Warning  | HV Bushing / TAP 1 | PD_U  | active   |

The event log shows which PD events triggered a warning (yellow) or alarm (red). By clicking on an event, the corresponding real-time or historical PD trend data can be viewed.

## 5 Trend data



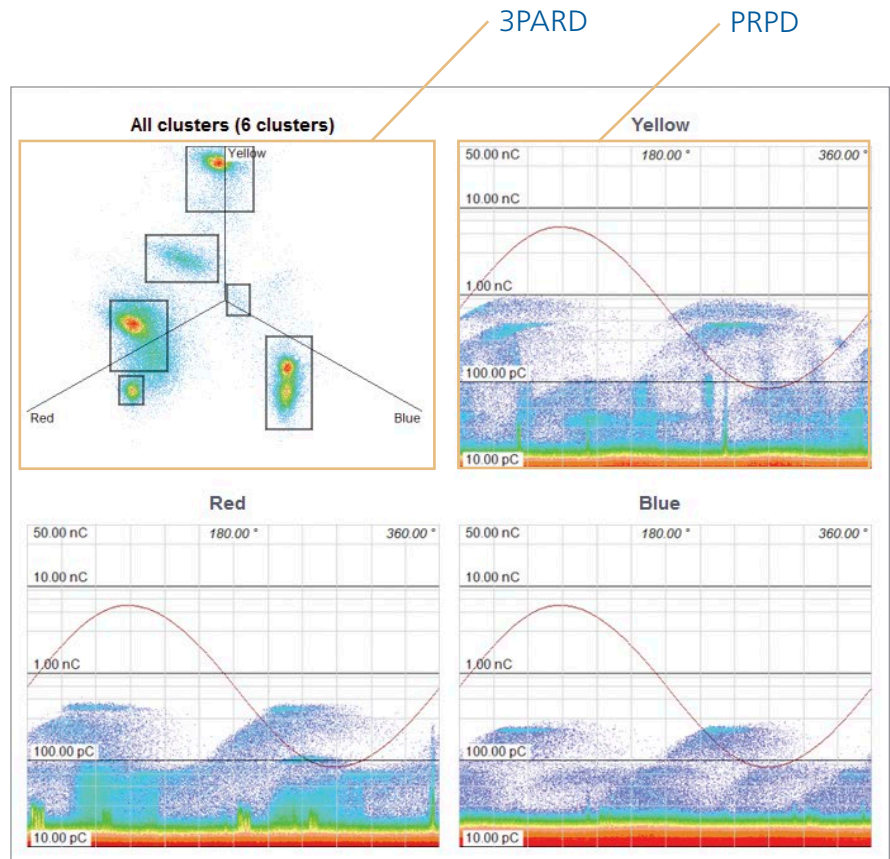
See PD trend charts for each phase or channel. Scroll over points to see PD values and zoom in to see more detail.

# Comprehensive analysis and reporting

## Automatic cluster separation

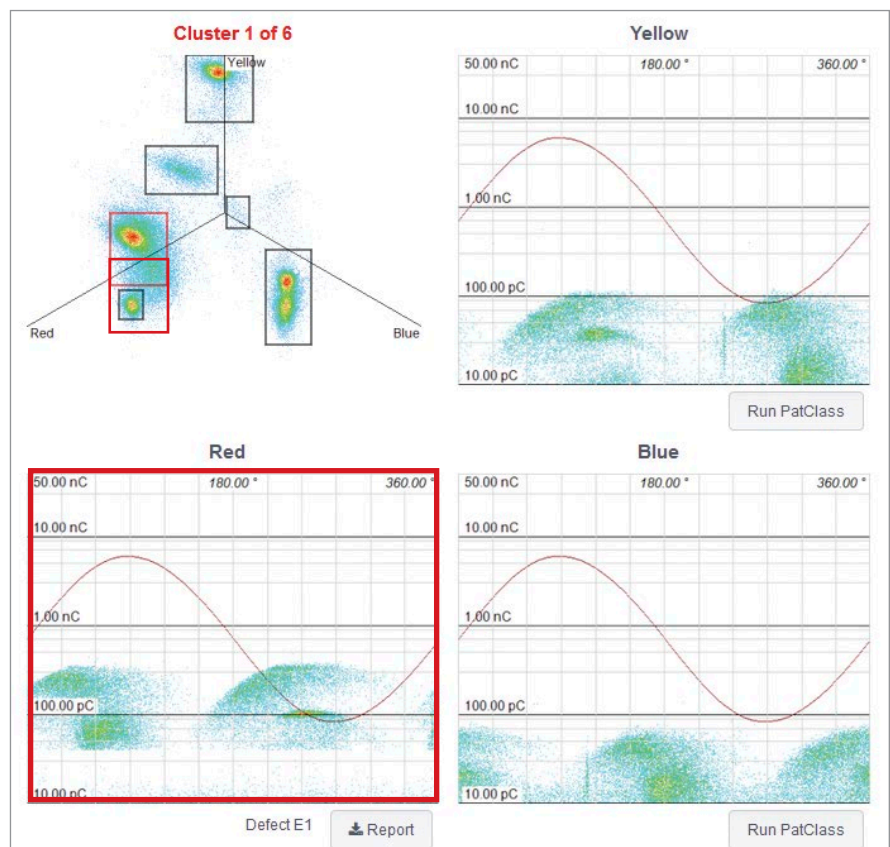
The advanced, web-based MONTESTO 200 software automatically stores PRPD (Phase-Resolved PD) patterns and the corresponding 3PARD (3-Phase Amplitude Relation Diagram) for each point in the PD trend diagram.

All signal sources are then automatically separated as clusters in the 3PARD to quickly differentiate between noise and PD for each phase.



Unfiltered data

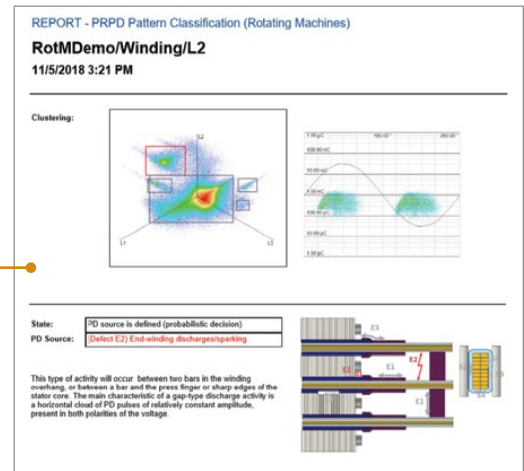
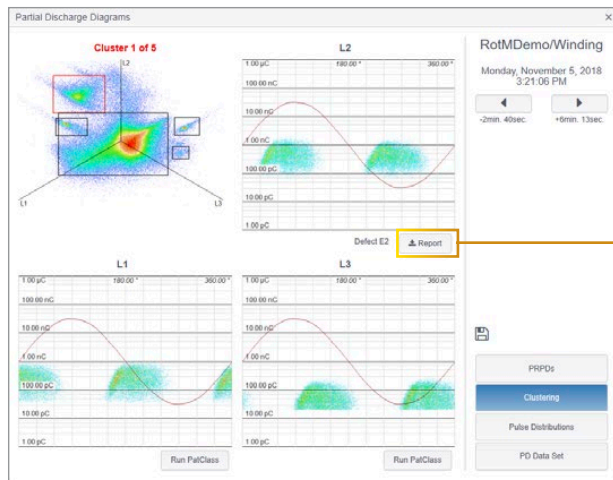
By clicking on a separated cluster, its individual PRPD pattern is shown. The most probable phase of origin is also identified after the separation is made.



Filtered data

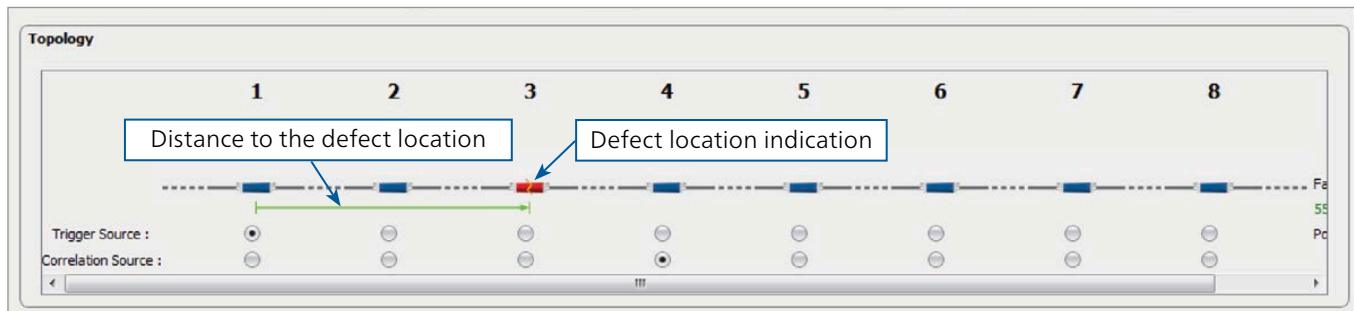
## Optional pattern classification for motors and generators

When enough data is available, the optional pattern classification analysis feature is performed for the phase with the highest amplitude to provide you with an explanation of the probable error.

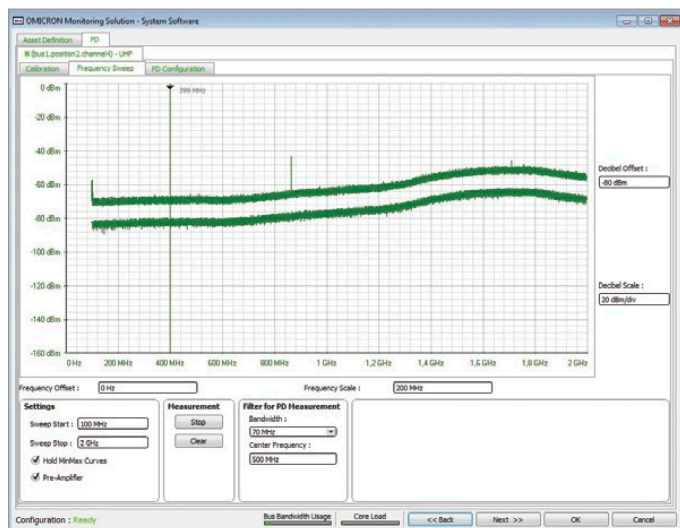


Automatic report with explanation of probable error

## Defect location in power cables



A unique, patented technology based on statistical Time Domain Reflectometry (sTDR) pinpoints the location of PD defects along the entire length of power cables.



## Frequency sweep diagram (UHF)

Several measurements are made for each frequency and the minimum (lower curve) and the maximum (upper curve) measured values are displayed. This method is used to detect any sources of interference in order to avoid them in a subsequent PD measurement.

# MONTESTO 200 ordering information

## MONTESTO 200

Includes the system components listed below

Order no.

VEHZ4184

### Hardware

- 1 x 4-channel PD data acquisition unit and an integrated Industrial PC (IPC) in a rugged case
- 1 x Transportation case
- 1 x Mounting kit (includes mounting plates and magnets)
- 1 x Media converter

### Pre-installed software on integrated Industrial PC (IPC)

- 1 x Advanced monitoring and PD analysis software
- 1 x Operating system software

### Cables and accessories

- 1 x Duplex fiber optic cable (10 m / 32.81 ft)
- 1 x Grounding cable (6 m / 19.68 ft)
- 1 x Grounding clamp
- 4 x Signal cable with TNC connectors (4 m / 13.12 ft)
- 1 x Power supply cord (2 m / 6.56 ft)
- 1 x Battery cable (2.5 m / 8.20 ft)
- 2 x Small crocodile clamps for battery cable
- 2 x Large crocodile clamps for battery cable

### Documentation

- 1 x MONTESTO 200 hardware user manual
- 1 x Software user manual
- 1 x OMS system software user manual

## Optional accessories

Order no.

### Hardware

- CAL 542 – PD calibrator
  - 1 pC ... 100 pC VE004210
  - 0.1 nC ... 10 nC VE004230
- Rogowski coil – Current signal reference for measurements on power cables VEHZ0623
- UPG 620 – Pulse generator for UHF signal verification VE004242
- UHF 620 – UHF bandwidth converter VEHZ4185
- WiFi modem VEHZ0094

### Software module

- Pattern classification for rotating machines VESM4109
- PD monitoring report VESM4110

## Application-specific accessories

Order no.

### 1 Terminal box

For use when PD sensors are permanently installed on various assets to enable plug-and-play, on-line PD measurement and monitoring.

- 3-channel terminal box VEHZ4176
- 4-channel terminal box VEHZ4175

### 2 Coupling capacitors

- MCC 117: 17.5 kV, 2.0 nF VEHZ4157
- MCC 124: 24 kV, 1.0 nF VEHZ4158
- MCC 117 permanent installation kit
  - Includes 3 x MCC 117, 1 x terminal box and 3 x tri-axial cables (5 m) with pre-installed connectors. VEHZ4177
- MCC 124 permanent installation kit
  - Includes 3 x MCC 124, 1 x terminal box and 3 x tri-axial cables (5 m) with pre-installed connectors. VEHZ4178



MONTESTO 200

### Application-specific accessories

Order no.

#### 3 CPL 844 permanent installation kit for bushings

Includes 3 x bushing tap sensors with adapters, 1 x terminal box and 3 x triaxial cables (10 m) with pre-installed IP65 connectors.

Current rating of the bushing sensors:

9 mArms ... 30 mArms

30 mArms ... 60 mArms

60 mArms ... 100 mArms

VEHZ4180

VEHZ4181

VEHZ4182

#### 4 UHF 620 bandwidth converter

Includes 1 x UHF 620 and connection cables in an IP65 case

VEHZ4185

### Application-specific accessories

Order no.

#### 5 UHF drain valve sensor for oil-filled power transformers

UVS 610: 150 MHz to 1 GHz

VEHZ4131

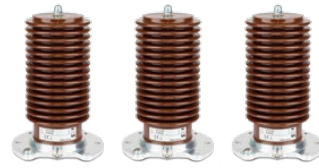
#### 6 High-frequency current transformers

MCT 120: 80 kHz to 40 MHz, split ferrite core

VEHZ4179



1 Terminal box



2 Coupling capacitors

Motors and generators  
Capacitive measurement



1 Terminal box



3 Bushing tap sensors and adapters

Power transformers  
Capacitive measurement



4 UHF bandwidth converter



5 UHF drain valve sensor

Power transformers  
UHF measurement



1 Terminal box



6 High-frequency current transformers

HV cable terminations and joints  
Inductive measurement

# Technical specifications

## MONTESTO 200

### Acquisition unit

|                                 |   |
|---------------------------------|---|
| Number of input channels        | 4   |
| Connector type                  | TNC   |
| Frequency range                 | Hardware: AC: DC ... 16 kHz<br>Software: Selectable,<br>10 Hz ... 450 Hz<br>PD: 16 kHz ... 30 MHz |
| Sampling rate                   | AC: 31.25 kS/s<br>PD: 125 MS/s  |
| Peak input levels               | AC: 200 mA<br>PD: 80 V  |
| Measurement accuracy            | AC: $\pm 0.25\%$<br>PD: $\pm 5\%$   |
| Maximum double pulse resolution | < 200 ns  |
| PD event time resolution        | < 2 ns  |
| PD filter bandwidth             | 9 kHz ... 5 MHz<br>(10 bandwidth settings)  |
| System noise                    | < 1 pC  |
| Power consumption               | max. 50 W   |

### Power supply

|                  |  |
|------------------|--|
| Mains            | AC: 100 V ... 240 V<br>DC: 110 V ... 150 V |
| External battery | DC: 12 V battery                           |

### Operating conditions

|                       |   |
|-----------------------|---|
| Operating temperature | -30 °C ... +55 °C<br>-22 °F ... +131 °F |
| Storage temperature   | -40 °C ... +80 °C<br>-40 °F ... +176 °F |
| Humidity              | 0 % ... 95 % (non-condensing)           |
| Protection class      | IP65                                    |

### Mechanical data

#### Dimensions (W x D x H)

|                      |  |
|----------------------|--|
| MONTESTO 200:        | 427 x 405 x 150 mm<br>16.81 x 15.94 x 5.90 in  |
| Transportation case: | 540 x 550 x 550 mm<br>21.26 x 21.65 x 21.65 in |

#### Weight

|   |                     |
|---|---------------------|
| MONTESTO 200:                             | 12 kg / 26.45 lbs   |
| With transportation case and accessories: | 28.50 kg / 62.83 lb |

### Internal PC

|                  |                         |
|------------------|-------------------------|
| Processor        | Intel Core i5-6300U CPU |
| Memory RAM       | 16 GB, DDR4             |
| Storage          | 500 GB, SSD             |
| Operating system | Windows 10              |

## Application-specific accessories

### 1 Terminal box

Used for convenient plug-and-play connections of permanently-installed PD sensors to MONTESTO 200 without service interruption.



#### Technical Data

|                  |  |
|------------------|--|
| Protection class | IP 66 (EN 60529)   |
| Input            | 3 or 4 channels equipped with 5m tri-axial cable and connectors<br>TNC 50 $\Omega$ female connectors with short circuit dust cap |
| Output           | 3 or 4 channels<br>Cable glands with outer shield connection<br>Connection point for grounding                                   |

### 2 MCC coupling capacitors

Different MCC coupling capacitors are available for various voltage levels.



| Technical Data             | MCC 117 (Option C) | MCC 124 (Option C) |
|----------------------------|--------------------|--------------------|
| $U_m$ (phase-to-phase)     | 17.5 kV            | 24 kV              |
| $C_{Nominal}$              | 2.0 nF (+/- 15%)   | 1.0 nF (+/-15%)    |
| Withstand Voltage (1 min.) | 38 kV              | 50kV               |
| $Q_{PD}$                   | < 2 pC @ 20.7 kV   | < 2 pC @ 27.6 kV   |
| Output connector           | TNC                | TNC                |

### 3 CPL 844 bushing tap sensors



A variety of bushing tap sensors are available with adapters for PD measurements on various bushing types. They are included with the *Terminal box* as part of the *CPL 844 Permanent installation kit for bushings*.

#### Technical Data

|                       |   |
|-----------------------|---|
| Current ranges        | 9 mArms ... 30 mArms<br>30 mArms ... 60 mArms<br>60 mArms ... 100 mArms |
| Max. output voltage   | 25 V  |
| Frequency range       | 16 kHz ... 10 MHz   |
| Output connector      | TNC   |
| Protection degree     | IP 66   |
| Operating temperature | -40°C ... +90°C (-40°F ... +194°F)                                      |
| Humidity              | up to 95% relative humidity<br>(non-condensing)                         |

### 4 UHF 620 bandwidth converter



Extends the measuring frequency range up to the VHF/UHF range and makes the detection of partial discharge more sensitive..

#### Technical Data

|                          |  |
|--------------------------|--|
| Frequency range          | 100 MHz ... 2000 MHz   |
| PD filter bandwidth      | 9 kHz ... 600 kHz (narrow band)<br>70 MHz (wide band)<br>1.9 GHz (ultra wide band) |
| Protection class         | IP66   |
| Connection cables        | Included   |
| PD event time resolution | < 2 ns   |

### 5 UVS 610 drain valve sensor



Allows PD measurements to be taken in liquid-insulated power transformers via the vent of an oil drain valve (DN50 or DN80).

#### Technical Data

|                  |   |
|------------------|---|
| Protection class | IP 66 / IP 67   |
| Frequency range  | 150 MHz to 1000 MHz   |
| Tightness        | up to 5 bar pressure<br>(at -15 °C to +120 °C /<br>at 5 °F to 248 °F) |
| Insertion depth  | 55 mm to 450 mm /<br>2.2 inch to 17.7 inches                          |

### 6 MCT 120 high-frequency CT



The MCT high-frequency current transformer (HFCT) picks up PD signals at a safe distance from high voltage. It is primarily intended for use on ground connections.

#### Technical Data

|                         |                             |
|-------------------------|-----------------------------|
| Frequency range (-6 dB) | 80 kHz ... 40 MHz           |
| Inner hole dimensions   | 53.5 mm / 2.11 inches       |
| Ferrite core            | Split                       |
| Output connector        | TNC (including BNC adapter) |

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 160 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.