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.

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**Temporary on-line PD monitoring**
- 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

**On-line PD measurement**
- Power transformers
- Power cables
- Motors and generators
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 3PARD (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.

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Front panel features at a glance

- 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
- 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)
- Four PD measurement channels
- Local asset status indication; automatic alarm notification via email (when configured by the user)
Local device status indication tells you the operating condition of the measurement unit.

Connection port for UHF sensor control.

Universal 12 V battery connection.

AC power connection.

Start/stop button.

Measurement device grounding connection.

Protection bumpers on both sides.
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.

Motors and generators

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.

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.
Power transformers

3b Bushing tap sensors and adapters

3c UHF drain valve sensor

3d High-frequency current 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](image)

**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

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.

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.
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.

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  

**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**

**Hardware**

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

**Software module**

- Pattern classification for rotating machines
- PD monitoring report

**Application-specific accessories**

**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
- 4-channel terminal box

**2 Coupling capacitors**

- MCC 117: 17.5 kV, 2.0 nF
- MCC 124: 24 kV, 1.0 nF
- 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.
- 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.
### Application-specific accessories

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>CPL 844 permanent installation kit for bushings</td>
<td>VEHZ4180</td>
</tr>
<tr>
<td></td>
<td>Includes 3 x bushing tap sensors with adapters, 1 x terminal box and 3 x triaxial cables (10 m) with pre-installed IP65 connectors.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Current rating of the bushing sensors:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>9 mArms ... 30 mArms</td>
<td>VEHZ4181</td>
</tr>
<tr>
<td></td>
<td>30 mArms ... 60 mArms</td>
<td></td>
</tr>
<tr>
<td></td>
<td>60 mArms ... 100 mArms</td>
<td>VEHZ4182</td>
</tr>
<tr>
<td>4</td>
<td>UHF 620 bandwidth converter</td>
<td>VEHZ4185</td>
</tr>
<tr>
<td></td>
<td>Includes 1 x UHF 620 and connection cables in an IP65 case</td>
<td></td>
</tr>
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</table>

### Application-specific accessories

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Order no.</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>UHF drain valve sensor for oil-filled power transformers</td>
<td>VEHZ4131</td>
</tr>
<tr>
<td></td>
<td>UVS 610: 150 MHz to 1 GHz</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>High-frequency current transformers</td>
<td>VEHZ4179</td>
</tr>
<tr>
<td></td>
<td>MCT 120: 80 kHz to 40 MHz, split ferrite core</td>
<td></td>
</tr>
</tbody>
</table>

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Motors and generators
Capacitive measurement

Power transformers
Capacitive measurement

Power transformers
UHF measurement

HV cable terminations and joints
Inductive measurement

High-frequency current transformers

# Technical specifications

## MONTESTO 200

### Acquisition unit

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of input channels</td>
<td>4</td>
</tr>
<tr>
<td>Connector type</td>
<td>TNC</td>
</tr>
<tr>
<td>Frequency range</td>
<td>Hardware: AC: DC ... 16 kHz</td>
</tr>
<tr>
<td></td>
<td>Software: Selectable,</td>
</tr>
<tr>
<td></td>
<td>10 Hz ... 450 Hz</td>
</tr>
<tr>
<td></td>
<td>PD: 16 kHz ... 30 MHz</td>
</tr>
<tr>
<td>Sampling rate</td>
<td>AC: 31.25 kS/s</td>
</tr>
<tr>
<td></td>
<td>PD: 80 V</td>
</tr>
<tr>
<td>Peak input levels</td>
<td>AC: 200 mA</td>
</tr>
<tr>
<td></td>
<td>PD: 80 V</td>
</tr>
<tr>
<td>Measurement accuracy</td>
<td>AC: ±0.25%</td>
</tr>
<tr>
<td></td>
<td>PD: ±5%</td>
</tr>
<tr>
<td>Maximum double pulse</td>
<td>&lt; 200 ns</td>
</tr>
<tr>
<td>resolution</td>
<td>PD event time resolution</td>
</tr>
<tr>
<td></td>
<td>PD filter bandwidth</td>
</tr>
<tr>
<td></td>
<td>(10 bandwidth settings)</td>
</tr>
<tr>
<td>System noise</td>
<td>&lt; 1 pC</td>
</tr>
<tr>
<td>Power consumption</td>
<td>max. 50 W</td>
</tr>
</tbody>
</table>

### Power supply

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mains</td>
<td>AC: 100 V ... 240 V</td>
</tr>
<tr>
<td></td>
<td>DC: 110 V ... 150 V</td>
</tr>
<tr>
<td>External battery</td>
<td>DC: 12 V battery</td>
</tr>
</tbody>
</table>

### Operating conditions

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operating temperature</td>
<td>-30 °C … +55 °C</td>
</tr>
<tr>
<td></td>
<td>-22 °F … +131 °F</td>
</tr>
<tr>
<td>Storage temperature</td>
<td>-40 °C … +80 °C</td>
</tr>
<tr>
<td></td>
<td>-40 °F … +176 °F</td>
</tr>
<tr>
<td>Humidity</td>
<td>0 % … 95 % (non-condensing)</td>
</tr>
<tr>
<td>Protection class</td>
<td>IP65</td>
</tr>
</tbody>
</table>

### Mechanical data

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions (W x D x H)</td>
<td>MONTESTO 200: 427 x 405 x 150 mm</td>
</tr>
<tr>
<td></td>
<td>16.81 x 15.94 x 5.90 in</td>
</tr>
<tr>
<td>Transportation case</td>
<td>540 x 550 x 550 mm</td>
</tr>
<tr>
<td></td>
<td>21.26 x 21.65 x 21.65 in</td>
</tr>
<tr>
<td>Weight</td>
<td>MONTESTO 200: 12 kg / 26.45 lbs</td>
</tr>
<tr>
<td></td>
<td>With transportation case and accessories: 28.50 kg / 62.83 lb</td>
</tr>
</tbody>
</table>

### Internal PC

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Processor</td>
<td>Intel Core i5-6300U CPU</td>
</tr>
<tr>
<td>Memory RAM</td>
<td>16 GB, DDR4</td>
</tr>
<tr>
<td>Storage</td>
<td>500 GB, SSD</td>
</tr>
<tr>
<td>Operating system</td>
<td>Windows 10</td>
</tr>
</tbody>
</table>

### Application-specific accessories

#### 1 Terminal box

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

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection class</td>
<td>IP 66 (EN 60529)</td>
</tr>
<tr>
<td>Input</td>
<td>3 or 4 channels equipped with 5m</td>
</tr>
<tr>
<td></td>
<td>tri-axial cable and connectors</td>
</tr>
<tr>
<td></td>
<td>TNC 50 Ω female connectors with</td>
</tr>
<tr>
<td></td>
<td>short circuit dust cap</td>
</tr>
<tr>
<td>Output</td>
<td>3 or 4 channels</td>
</tr>
<tr>
<td></td>
<td>Cable glands with outer shield connection</td>
</tr>
<tr>
<td></td>
<td>Connection point for grounding</td>
</tr>
</tbody>
</table>

#### 2 MCC coupling capacitors

Different MCC coupling capacitors are available for various voltage levels.

<table>
<thead>
<tr>
<th>Technical Data</th>
<th>MCC 117 (Option C)</th>
<th>MCC 124 (Option C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>$U_{ph}$ (phase-to-phase)</td>
<td>17.5 kV</td>
<td>24 kV</td>
</tr>
<tr>
<td>$C_{num,}$</td>
<td>2.0 nF (+/-15%)</td>
<td>1.0 nF (+/-15%)</td>
</tr>
<tr>
<td>Withstand Voltage (1 min.)</td>
<td>38 kV</td>
<td>50 kV</td>
</tr>
<tr>
<td>$Q_{pd}$</td>
<td>&lt; 2 pC @ 20.7 kV</td>
<td>&lt; 2 pC @ 27.6 kV</td>
</tr>
<tr>
<td>Output connector</td>
<td>TNC</td>
<td>TNC</td>
</tr>
</tbody>
</table>
### 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
  - 30 mArms ... 60 mArms
  - 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 (non-condensing)

### UHS 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)
  - 70 MHz (wide band)
  - 1.9 GHz (ultra wide band)
- **Protection class**: IP66
- **Connection cables**: Included
- **PD event time resolution**: < 2 ns

### 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 (at -15 °C to +120 °C / 5 °F to 248 °F)
- **Insertion depth**: 55 mm to 450 mm / 2.2 inch to 17.7 inches

### 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.