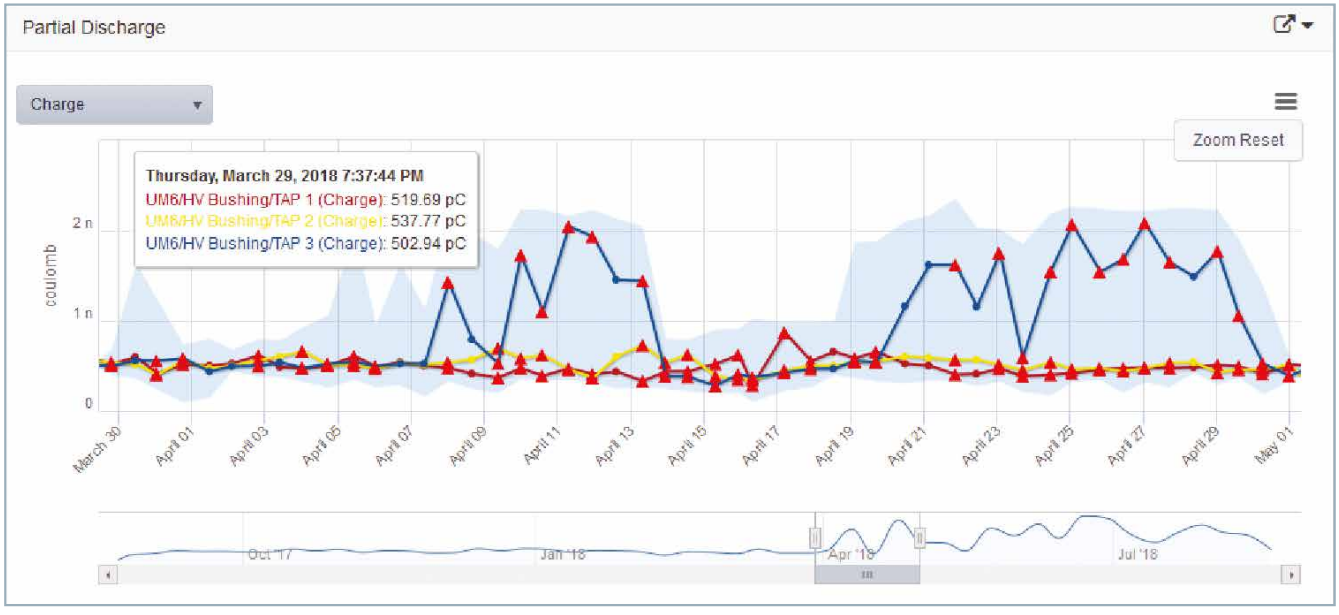
OBSERVING PARTIAL DISCHARGE OVER TIME

MONTESTO 200 is our portable system for temporary online PD monitoring and trending insulation status between diagnostic checks.

In this article, we interviewed our MONTESTO 200 Product Manager Bogdan Gorgan about how our temporary online partial discharge (PD) monitoring system helps you oversee PD activity in a wide variety of high-voltage (HV) equipment. He also presents a case study about how MONTESTO 200 was used for a two-week in-service assessment of an older rotating electrical machine's insulation condition.

Can you explain the importance of PD measurements and when they're usually performed?

Bogdan Gorgan: PD measurements are recognized worldwide for insulation diagnosis and are usually required for most high-voltage equipment acceptance testing procedures. Detected PD activity is often a sign of developing insulation defects. Based on the absence or presence of PD activity during routine tests, onsite tests, or periodic in-service inspections throughout the service lifetime, conclusions can be drawn about the actual condition of the dielectric insulation system. Due to the ongoing aging of insulation systems in high-voltage components in service, PD testing and diagnostic methods are being used increasingly in condition monitoring on a temporary short-term or permanent long-term basis. We offer solutions for each of these PD testing and monitoring applications.



Trend visualization with time stamps generated by MONTESTO 200 temporary online PD monitoring system.

What is the difference between offline and online PD testing?

PD can be measured offline, such as with our MPD 800 PD measurement and analysis system. In this case, the asset is energized by a separate HV source. PD can also be measured or monitored online while the asset is connected to the electrical grid and in operation – either with the MPD 800 or our MONTESTO 200 temporary PD monitoring system – using permanently-installed PD sensors and a terminal box.

Please explain what PD monitoring means and how it differs from online PD testing.

Online PD monitoring is the process of continuously observing and trending partial discharge activity over time to assess insulation condition, identify potential weak spots, and determine the level of risk for a dielectric failure. The information from the PD sensors is synchronously measured by the multi-channel acquisition unit and stored in a database. The measurement synchronicity between the channels enables the separation of noise and PD signals. The data is trended over the specified time period and compared with user-defined thresholds to determine whether a problem is developing.

When it comes to temporary PD monitoring, an online PD measurement is continuously performed over a few days, a week, a month, or even a year to obtain a more detailed picture of progressive deterioration in the electrical insulation. Compared to periodic PD measurements, temporary PD monitoring allows you to observe the behavior of different PD defects over time and how they relate to different operating parameters, such as temperature, load, and humidity. It is performed to evaluate the overall insulation condition on assets with confirmed PD activity to ▸

***«The data is trended over the specified time period and compared with user-defined thresholds** to determine whether a problem is developing.»*

Bogdan Gorgan,
Product Manager,
OMICRON

LISTEN TO THE PODCAST

Interested in this topic?

Be sure to listen to our Energy Talks Podcast Series Episode Number 38 about the temporary monitoring of partial discharge activity with Bogdan Gorgan. Scan the QR-Code or visit:

omicronenergy.com/temporary-pd

MONTESTO 200 can be easily mounted on the asset for continuous online PD monitoring for longer periods of time.

trend its rate of development and determine when a future repair or replacement is needed. It is also performed on repaired assets to check the quality and effectiveness of the repair and to oversee its condition for longer periods of time. The trend evaluation is therefore an addition to the classic offline diagnosis using an external voltage source.

Could you describe how our MONTESTO 200 system is used for short-term and long-term continuous PD monitoring.

MONTESTO 200 is a portable device that allows the user to perform temporary PD monitoring when and where it's needed on different assets, like power transformers, motors and generators as well as power cables.

Pre-installed PD sensors are connected to a terminal box, which enables plug-and-play PD measurements and temporary PD monitoring at any moment during operation. The MONTESTO 200 acquisition unit is easy to transport to various locations and is compact enough for use in limited spaces. It can be used onsite with a laptop or mounted on the asset and operated remotely via the web-based user interface.

Users can set up the system in six easy steps with the accompanying Monitoring Software to perform temporary PD monitoring sessions. The MONTESTO 200 acquisition unit measures and stores the PD sensors' data in periodic or continuous mode. The periodic measurements are initiated based on what the user specifies in the monitoring session setup, for example, every hour. In continuous mode, the data is acquired every second and compared with defined user threshold values and shown in the web-based software user interface in real-time.

If needed, automatic alarms can be configured, and the user is notified when measurement values exceed defined threshold values. For automatic alarming by email, the MONTESTO 200 must be connected to the Internet via a router and an SMTP server must be configured by the user. The results from monitoring sessions on different assets are stored in a single database, and specific data can be selected for visualization and a more detailed comparison and evaluation.

Bogdan, a major challenge when performing online PD measurements is dealing with external noise. How does MONTESTO 200 handle this during temporary PD monitoring?

Measurement sensitivity is always a challenge when performing online PD measurements due to the high external noise levels on site. Like our diagnostic MPD 800 PD measurement and analysis system, MONTESTO 200 can be tuned to the frequency that gives the best signal-to-noise ratio. Tuning the filter settings is the first step to systematically avoiding noise.

In addition, our 3-Phase Amplitude Relation Diagram method, also known as 3PARD, is applied in the monitoring software for removing disturbances and clearly distinguishing between multiple PD sources. Our unique cluster separation technique is applied when using the 3PARD method — this enables the precise separation of PD activity from other PD-like signals so that the most likely phase can be located.

CASE STUDY – TEMPORARY PD MONITORING ON A ROTATING ELECTRICAL MACHINE

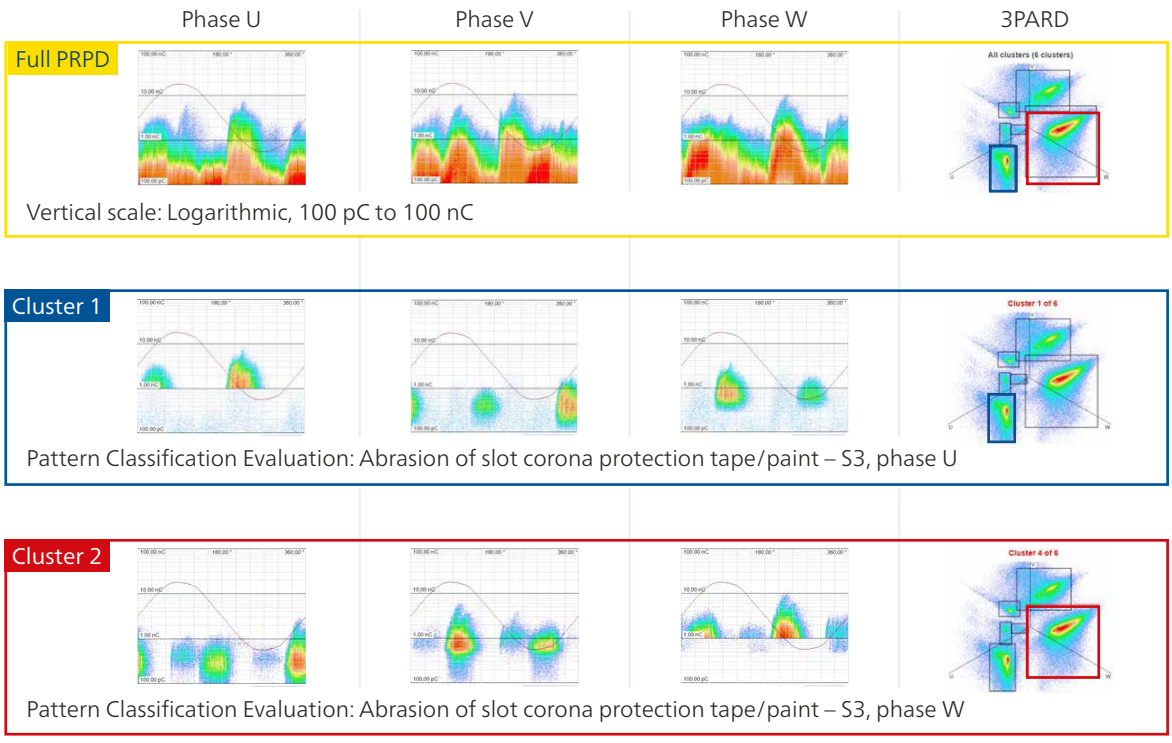
A two-week temporary PD monitoring session was recorded with MONTESTO 200 on an aging 6.3 kV synchronous generator with an output of around 10 MVA in an industrial plant. Coupling capacitors were permanently installed to enable periodic online measurements and temporary monitoring on each phase of the generator and connected to the terminal box. The MONTESTO 200 acquisition unit was connected via plug-and-play to the same terminal box. The PD charge and voltage trend were recorded over the specified two-week time period to determine the insulation's condition, which could then be compared with other generators of the same type, history, and age in the plant.

The Phase-Resolved Partial Discharge (PRPD) patterns for all three phases as well as the 3PARD diagram with automatic clustering were generated for selected time stamps in the trend chart. The clusters that appear in the related PRPD patterns were individually selected to evaluate possible PD defects, which were separated from any disturbance signals.

The probable type of the PD defect could be determined with a software feature specifically used for rotating electrical machines, called Pattern Classification. The monitoring software was then used to automatically generate a customized report with relevant data and charts.

The results showed a slight but steadily increasing charge trend. PD patterns showing surface discharge defect can be seen on the end winding, which can mainly be explained by dirt and impurities. The increase in the charge values shows that the PD activity is increasing. Therefore, a continuous aging process is taking place.

Based on the reported data, the user was able to document the stator insulation condition in terms of defect type and trend. The user decided that the documented results showed no immediate risk of machine failure. After a few months, a decision was made to repeat the PD monitoring sessions to observe the evolution and plan any necessary maintenance.



The resulting PRPD patterns for the three monitored phases are generated for each of the six clusters automatically identified in the 3PARD. This helps you identify defects in the insulation. Possible causes of the documented PD activity are indicated using the Pattern Classification feature for rotating machines.