

PD-Guard & PD-Guard/UHF



TOGETHER WE POWER THE WORLD®

Advanced & Reliable On-Line PD-Monitor

PARTIAL DISCHARGE MONITOR

The Doble Lemke PD-Guard is especially designed for on-line, highly sensitive continuous PD monitoring of three-phase high voltage rotating machines such as turbo generators, hydro generators and high voltage motors or other HV apparatus such as transformers and GIS.

The PD-Guard is available in two configurations, the traditional PD-Guard for measuring electrical transients up to 2MHz and the PD-Guard/UHF which is capable of sensing UHF signals from antennae installed inside HV apparatus. This system complies with IP65 industry standards and can survive the harshest environments to include direct spray. A complete software suite is included for the analysis of PD activity so corrective action can be taken before failure occurs.

Features

Advanced Analysis & Alarm Tools

Using internationally recognized algorithms approved by IEEE and IEC, the best possible diagnosis for fault conditions can be realized. These tools include Phi-Q-N, Phi-Q and Phi-N displays. Alarm setpoints can be set-up from the beginning and modified over time as normal operating conditions are learned.

Rugged and Reliable

This system complies with IP56 industry standards and can survive the harshest environments to include direct spray. The system can be mounted on a wall or rack in any position.

Interference Rejection

Nothing is more problematic than the interference caused by on-site noise, exciters and external interference. When used to monitor rotating machines, a gating sensor removes unwanted exciter noise from the signal before evaluation. Adjustable internal digital filter improve the rejection of interference and removes broadcasting frequencies.

State of the Art

With advanced noise rejection, pulse sequence recording and frequency domain signal conditioning, the unit can be used to make critical decisions with data you can trust.

Scalable

The PD Monitoring Server can act as the central hub to one or several PD-Guard monitors. Each PD-Guard has its own unique IP to identify it on the network.

Multi-Channel Acquisition

The PD-Guard can monitor up to four channels. The PD-Guard/UHF has the additional ability of monitoring UHF signals between 300 MHz and 2 GHz for deep localized fault detection.

Multiple Applications

The PD-Guard can be used to monitor rotating machines, transformers and insulated buswork.

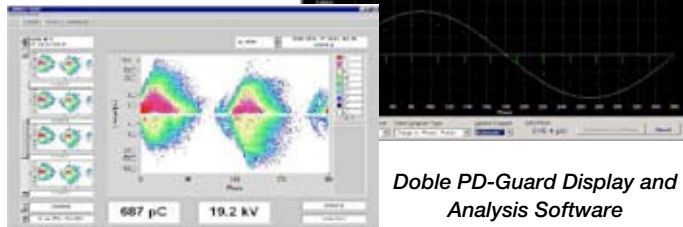


Advanced Partial Discharge Monitoring

The PD Guard includes the PD-Guard monitoring unit as well as the PD Evaluation Server. Together they provide all the tools necessary to read partial discharge sensors, monitor PD levels, and conduct analysis.

The Doble PD-Guard & PD-Guard/UHF

At the heart of an online partial discharge monitoring system is the highly compact, rugged, and light-weight Doble PD-Guard. This provides all inputs necessary to monitor the partial discharge from the three phase machine bus as well as the neutral. The PD-Guard provides input for HF interference gating, thus allowing the system to remove unwanted exciter noise. You only monitor the condition of the machine. The PD-Guard is a ULTRA rugged unit that can withstand the rigors of an industrial environment. It is designed for fully-automatic, continuous, service-free, long-time operation and can be easily mounted in any position. The PD-Guard is equipped with a green/red LED that indicates the alarm status of each individual channel. This indication is also available remotely through the network on the supplied analysis software.



The PD-Guard and Analysis Software includes:

- Pulse sequence recording
- Noise rejection
- Frequency domain signal conditioning
- Test voltage measurement and synchronization, mains and external sync.
- Four channel monitoring of partial discharges in motors/ generators, transformers and other HV equipment
- PD measuring, analysis and displaying of test voltage
- Automatic calibration-- calibration data will be stored for each channel separately
- Display of green/red indicator per phase per apparatus, based on alarm level. The same indication is available locally on the PD-Guard device (LED display) for simplified supervision.
- Replay of several PD quantities and derived quantities (Phi-Q graph, Phi-Q-N pattern, Q-N graph and alarm template) in compliance with international standards
- Channel can be selected for full-screen scale with display of live PD graphics
- All displayed windows can be stored on hard disk as a graphics file

PD Evaluation Server

The PD Evaluation Server can communicate with one or multiple PD-Guard monitors. This makes the system truly scalable and manageable from a single location. The server controls the processing of measurement jobs, generates alarms and performs backups. The server is connected to the PD-Guard using a fiber optic connection, thus minimizing unwanted noise. Data can then be passed back to the PD-Guard software where analysis software provides real-time and historical display of PD magnitude and peak values in accordance with IEEE and IEC standards. Included analysis and display tools can be used to characterize, diagnose and setup alarms. The analysis tools include Phi-Q graphs, Phi-Q-N pattern and Q-N alarm templates.

The PD-Guard and Analysis Software includes:

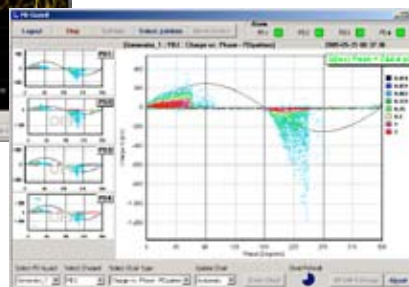
- Display and transmitting of the following history functions in real-time
 - PD magnitude as peak value or as average value
 - PD magnitude weighted to the IEC 60270 characteristic
 - PD Current
- Easy alarm setting-- can be configured for each measuring device and measuring channel separately
- Feature to program (via SETUP) automatic testing procedures (testing time, sequence of measuring channel activation)



1 NORMAL OPERATION
Auto-Alarm



2 ENQUIRY
Trending



3 ENQUIRY
Pattern Analysis

Increasing information depth from "Status Quo changed" to "failure patterns"



Common way of working with installed monitoring

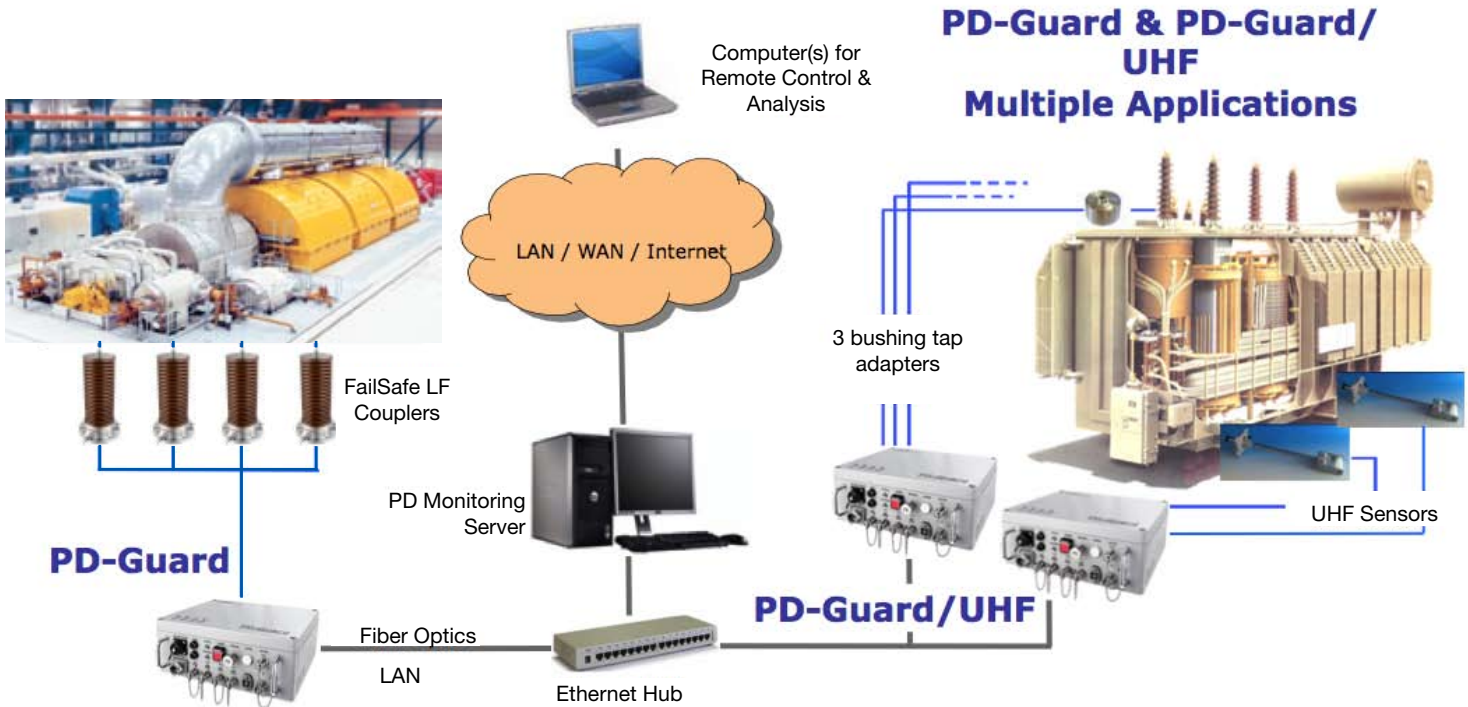
Multiple Applications

The equipment for PD monitoring on HV power apparatus is especially designed for on-line highly sensitive continuous PD monitoring in three-phase HV rotating machines, transformers and insulated buswork. The transient signals in the insulation system caused by PD will be measured in order to assess the insulation status. It is possible to do continuous PD analysis as well as phase resolved PD measurements. Also, the PD signal representation, storage and evaluation in combination with corresponding test voltage information, is recorded and sent to the PD Evaluation Server for alarming via a Ethernet TCP/IP network connection.

For Generators, Doble FailSafe Couplers are connected to the windings/bus bar of each phase and the neutral. The system evaluates the signal trend of the discharges in the equipment. Measuring sensitivity is automatically controlled.

For transformers & GIS, UHF sensors are mounted through hatch cover facilities, buswork enclosure, drain valves or to a bushing PD sensors.

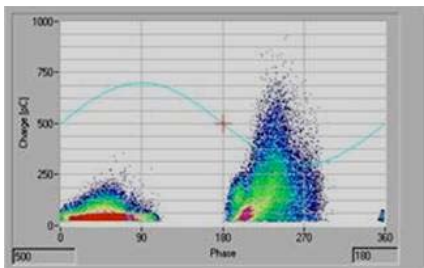
To increase the safety and to separate the systems galvanically, the PD-Guard unit can be interconnected via a fiber-optic network cable. Adjustable internal digital filters improve the noise rejection of interference and broadcasting frequencies



Why use the Doble PD-Guard Monitoring Device?

Discharge pulses travel through the winding via the inductive, capacitive and resistive impedance network. IEC 60270 defines a measurement frequency range of f_1 : 30 -100 kHz and f_2 : 500 kHz. In this range the dominant propagation path is standing waves and relatively little signal power is lost by attenuation. However travelling waves are not propagated above a maximum frequency where L and K are the series inductance and capacitance.

For most large generators and motors, this works out at a few megahertz. Above this, the coupling is capacitive through the series and shunt capacitances. Here the high value of the latter ensures that attenuation is high. Early On-line PD monitoring systems detected at several tens of megahertz. This avoided high levels of interference, but resulted in only a very small part of the winding nearest to the HV connection being monitored for partial discharge. More modern systems, like the PD-Guard, can operate below 1MHz because they use more sophisticated signal processing and noise suppression. Modern signal processing also allows pulse phase resolution and this is invaluable in identifying the type or source of the partial discharges. This makes the visual inspection much easier.



$$f_{max} = \frac{1}{\sqrt{L \cdot K}}$$

The PD-Guard/UHF model has the additional ability of monitoring UHF antennae sensors. UHF sensors have the increase advantage of being mounted within the apparatus allow the ground wall to act as a "Faraday Cage". This effectively blocks out external noise, allowing the system to just listen to partial discharge sourced from the apparatus. UHF sensors have the additional benefit of being directional and localized, allowing a system to find defects deep within the apparatus.



Service Package or Lease Options Available

- To install the couplers and terminal box outside the casing
- To install the diagnostics and set up the system and alarm features, it is very important to configure the alarm values and take an initial fingerprint of the monitored generator
- To review and report on a quarterly basis, and respond as required to any alarms.
- If leased, Doble will provide any and all replacement components and provide expert review.

For more information, contact
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Doble is certified ISO 9001:2000
Doble is an ESCO Technologies Company

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