

# TransformerGuard



TOGETHER WE POWER THE WORLD®

## **A Complete Partial Discharge Monitoring System for Transformers**

### **PD MONITORING SYSTEM**

The Doble Lemke TransformerGuard is a monitoring system for assessing the condition of transformers in the field. The system is an on-line partial discharge (PD) monitoring system for power transformers. By monitoring the in-service partial discharge, the insulation performance can be reliability assessed over time and corrective action can be taken before a failure occurs.

True to form, the Doble Lemke TransformerGuard provides all the tools necessary to install a permanent online monitoring system for a single transformer, but can also be expanded to include the bushings or other transformers. Doble supplements our system by providing the support for commissioning, calibration and analysis. You're never alone with Doble. TransformerGuard complies with all IEEE and IEC standards on partial discharge testing.

### **Features**

#### **Highly Sensitive UHF PD Detection**

By using UHF sensors, PD sources can be sensed within the transformer without obstructions. By mounting the UHF sensors within the tank, the tank wall effectively screens out external interference.

#### **Advanced Analysis Tools**

Using internationally recognized algorithms approved by IEEE and IEC, the best possible diagnosis of fault conditions can be realized. These tools include Phi-V-N, Phi-V and Phi-N displays. Alarming setpoints can be setup from the beginning and modified over time as the transformer's normal operating conditions are learned.

#### **Scalable**

The PD Evaluation Server can act as the central hub to one or several PD-Guard / UHF monitors. Each PD-Guard has its own unique IP address to identify it on the network. The unit can be upgraded to include bushing PD sensors.

#### **Rugged and Reliable**

Central to TransformerGuard is the rugged PD-Guard/UHF monitor that makes physical connection to the sensing points. This system complies with IP65 industry standards and can survive the harshest environments to include direct spray.

#### **Condition Based Maintenance**

Given its online diagnostic capabilities, and ability to set alarms, the system can provide advanced notification of impending failure. Better decisions can be made earlier.

#### **Interference Rejection**

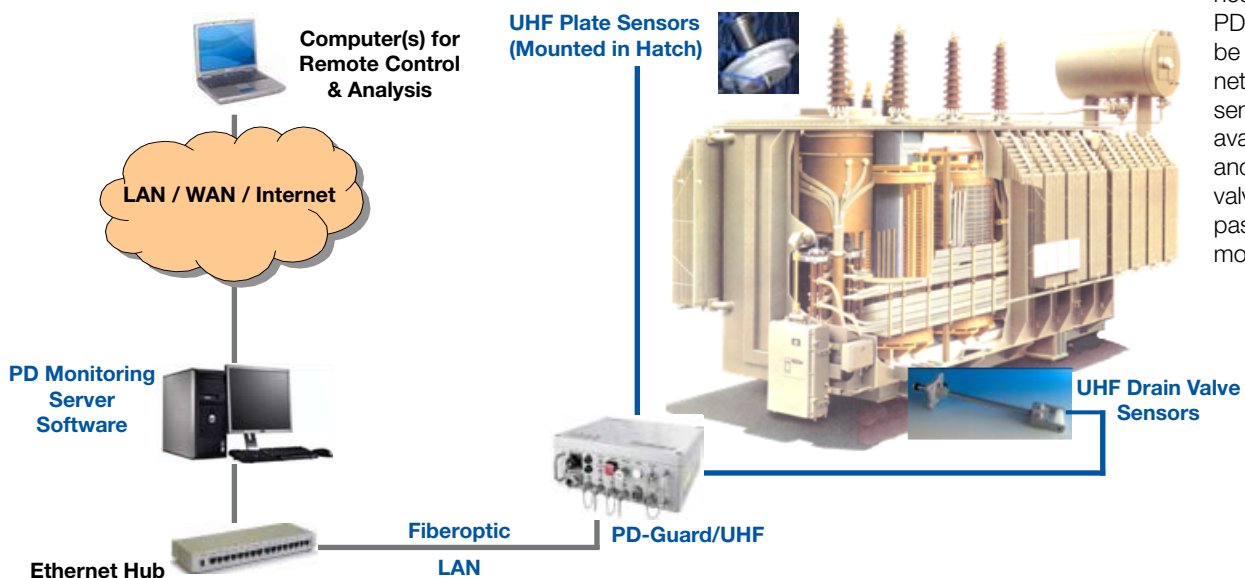
By using UHF technology, external noise is effectively removed. In addition the unit measures between 100 to 1000 MHz, thus localized the detection to the transformer, not the surroundings.

#### **Choice of UHF Sensors**

Based on the facilities available, up to 4 UHF sensors can be connected to one PD-Guard/UHF. If additional sensors are

needed, additional PD-Guards can be added to the network. UHF sensors are available for DN50 and DN80 drain valves (straight pass) or hatch mounting.

### **TransformerGuard**



## Why use the Doble TransformerGuard?

TransformerGuard gives early warning to partial discharge damage within the transformer while the unit operates under normal conditions. The software monitors trends in magnitude and repetition rate, and if this exceeds a preset condition, an alarm is set alerting the owner to a possible problem. TransformerGuard fits well within a condition based maintenance program.

PD detection is accepted by industry experts, IEEE and IEC as one of the key diagnostics for transformer equipment, and can be used as an integral part of asset risk management. Transformers are one the most costly apparatus within a power plant or substation and understanding their condition is paramount. The system is tunable between 100 and 1000 MHz. This means that the PD can be localized to the transformers and is not blocked by internal structures.

Over 50% of large transformers around the world are 40 years old. While many should have significantly more years of safe service remaining, there will equally be many where the risk of an in-service failure is high. At this age, their future lives depend significantly upon the design, build quality, loading, and maintenance. Also important is the exposure to abnormal conditions as it will be such an event that will trigger the end of life of a deteriorated transformer. Examples of such triggers would include electrical transients and short circuits.

## Turn-key System

### Commissioning and Calibration

Doble provides all the tools, sensors, cables and software. We can even provide computer based servers if not already available. Our staff will install, calibrate and verify proper operation. Of course, we will train staff on how to operate and maintain the system. After the system is in service, Doble will assist in the analysis and tuning of the system alarms.



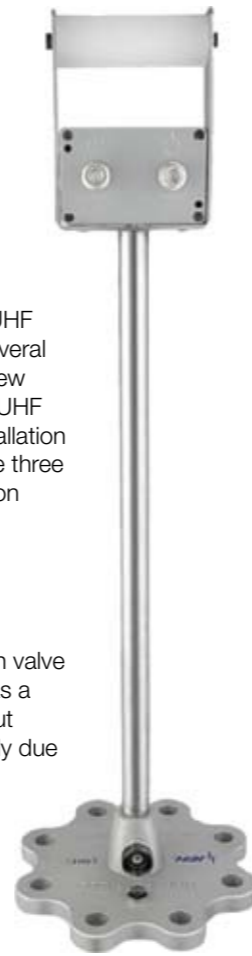
*PD Monitoring System installed*

### UHF Probe Versatility

Managing risk through condition assessment of transformers was recently reviewed by CIGRE in A2-27 Brochure 343, 2008. This document identified locations (i.e. facilities) for mounting PD sensors in the transformer purchase specifications. Though a simple UHF PD monitoring system could include a single UHF probe, the study recommends included several more. The system can be scaled from as few as one to four UHF probes per PD-Guard/UHF monitor. These facilities will allow easy installation of UHF probes at a suitable time. There are three types of UHF probes available depending on facilities and access:

- DN-50 Drain Valve UHF Sensor
- DN-80 Drain Valve UHF Sensor
- Plate (Hatch Mountable) UHF Sensor

When the UHF probe is mounted to a drain valve or hatch cover, the transformer tank acts as a "Faraday Cage". This effectively screens out interference allowing measuring signals only due to PD within the transformer.

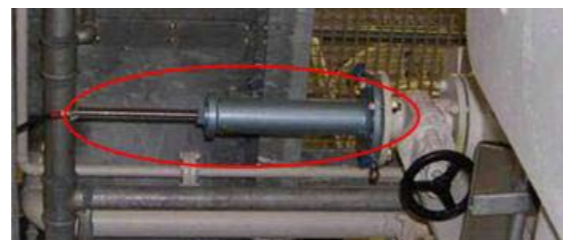


### TransformerGuard Architecture

A typical TransformerGuard PD Monitoring System consists of:

- 1 DN50 or DN80 Drain Valve UHF Sensor
- 1 Plate UHF Sensor
- 1 PD-Guard/UHF Partial Discharge Monitor
- 1 Fiber-optic Link
- 1 License for the PD Evaluation Server and associated PD-Guard/UHF Analysis Software
- 1 External Calibrator LDC-5/S2

If necessary, Doble can arrange for the installation of the required conduit and mounting hardware, enclosures and computer systems.



*UHF drain valve sensor installed*

## The "Complete Package"

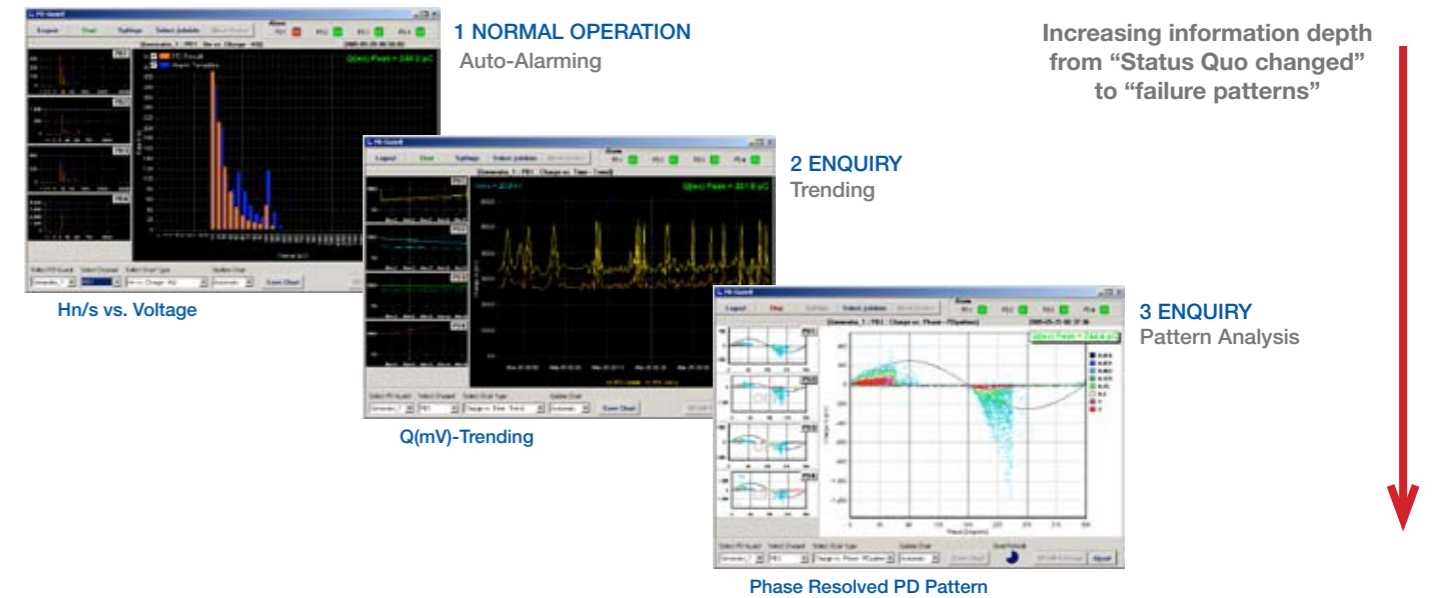
We don't deliver parts, we deliver the whole package. TransformerGuard is composed of a suite of products that are optimized for deep winding fault analysis and diagnosis without compromising the reliability of the apparatus. Key components and services included in TransformerGuard are:

### The Doble PD-Guard/UHF & UHF Probes

At the heart of TransformerGuard is the highly compact, rugged, and light-weight Doble PD-Guard/UHF. This provides all inputs necessary to monitor the partial discharge from UHF probes mounted in drain valves and hatch covers. The PD-Guard/UHF is a ULTRA rugged unit that can withstand the rigors of an industrial environment. It is designed for fully-automatic, continuous, maintenance-free operation and can be easily mounted in any position.

### PD Evaluation Server

The PD Evaluation Server can communicate with one or multiple PD-Guard/UHF 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 viewed from a remote PC running the analysis software. The analysis software provides real-time and historical display of PD magnitude and peak values in accordance with applicable IEEE and IEC standards. Included analysis and display tools can be used to characterize, diagnose and setup alarms. The analysis tools include Phi-V graphs, Phi-V-N pattern and V-N alarm templates.



### Doble PD Support

You're never alone with Doble. Doble provides site commissioning, training and diagnostic services through our established Doble Client Service Engineering group. This group of over 35 client support engineers in 7 countries worldwide is available 24/7 to provide assistance when you need it.

## Service Package or Lease Options Available

- To install sensors and terminal box.
- 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 transformer.
- 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.
- Provide quarterly reports on transformer health based on PD activity.

# Key Specifications\*

## PD-Guard /UHF

- Display and transmission of PD history in real time
- PD magnitude as peak or average value
- PD current
- Noise rejection
- Frequency and domain signal conditioning
- Easy alarm setting can be configured for each measuring channel separately
- Automatic testing procedures for testing time, and sequence of activation
- 4 channel monitoring of partial discharge
- 100 to 1000 MHz bandwidth

## UHF Sensor

- Signal decoupling range 300 MHz to 1 GHz
- Drain valve designs are leak tested for oil temperatures at 120°C at 5 bar pressure
- DN50, DN80 and Plate Sensors available

## Pulse Generator LDC-7/UHF

- Sensitivity verification of PD measuring circuit
- Output signal ranges (at 50 Ohm): 0 to 60 V
- Resolution: < 1 % of the measuring range
- Charge pulses rise time (at 50 Ohm):  $\leq 200$  ps
- Decay time constant: approx.  $\sim 100$  to  $200$  ns
- Pulse repetition rate: 100 Hz, adapted to synchronization with line frequency
- 3½-digit digital display (LCD) for displaying the voltage value
- Battery powered

## PD Evaluation Server & PD-Guard Analysis Software

- Display and transmission of PD history in real time
- PD magnitude as peak or average value
- PD magnitude weighted to the IEC 60270 characteristic
- Noise rejection
- Frequency and domain signal conditioning
- Easy alarm setting, can be configured for each measuring channel separately
- Automatic testing procedures for testing time, and sequence of activation
- 4 channel monitoring of partial discharge
- 100 to 1000 MHz bandwidth
- Requires a separate central PC Server for installation

*\*Requires a separate central PC Server for installation*

## Doble Support

- Expert PD analysis by a Doble Expert
- Support available 24 hours a day 7 days a week

*\* Please refer to individual component product brochures for a more complete list of specifications.*

*Specifications are subject to change without notice.*

For more information, contact

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or visit

**[www.doble.com](http://www.doble.com)**



**Doble is certified ISO 9001:2000  
Doble is an ESCO Technologies Company**

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