Doble PRIME Analytics Pt. 1

Doble PRIME

Doble PRIME is a state of the art condition monitoring platform which uses advanced analysis of condition data to give actionable information in a timely manner. Built on Doble's decades of experience in monitoring and equipment, PRIME consists of several monitoring modules, tied together through an Analytics unit – the modules may also be deployed 'stand-alone' where required: The modular format of Doble PRIME Analytics and PD Guard is shown below.

The Analytics unit also includes its own analog and digital I/O and extensive communication/hub capabilities and data back up; Doble PRIME Analytics will accept data from any standard condition monitoring device.

Doble PRIME PD Guard

Partial Discharge (PD) is a sign of deteriorated or degraded insulation which may be detected by the Doble Prime PD Guard. PD is a source of broadband radio energy – allowing detection by PD Guard which monitors across a user defined frequency spectrum.

PD Guard Measurements

A typical spectrum in process of being recorded is shown below; frequency range from 50 kHz to 100 MHz. This is a typical measurement range for rotating machines. The PD Guard shows the PD level measured at each frequency; it is usual to analyze spectra as a 'fingerprint' and note that a PD source will provide a higher level of energy compared to a baseline measurement or compared to other locations. Statistical analysis of spectra allows for automated and auditable analysis.

PD Guard Statistics and Analyses

The spectrum produced is analyzed both as a complete 'global' measurement and as a series of 'sub bands'. Two statistics are derived for the global measurement and for each band: the total energy in the signal, or integrated power, IPwr and the peak to average power ratio, PAPR, which is an indicator of the presence of a PD source rather than, say a communications or electronics source.
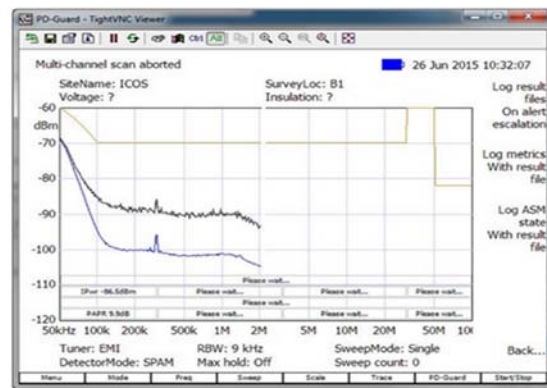
Each measurement thus produces 12 statistics which can be tracked and analyzed to detect PD. Analysis results in either a 'nominal' *state* or three levels of alert *state*: INFO (Information), followed by WARNING and ACTION. These four *states* are set with default levels which the user can configure.


PD Guard Alert State-Machine (ASM)

Doble has developed a unique Alert State-Machine to manage PD analysis. For a PD source to be identified by condition monitoring, there is an expectation that the signal will be sustained – unlike, say, a switching impulse or fault current transient. A single measurement statistic does not transition the ASM from NOM to INFO – the default setting is two successive readings; likewise three successive readings are required to transition from INFO to WARN; the levels and number of transitions are user configurable.

The result of the ASM analysis is a state which truly reflects the presence of PD within the insulation. The user can apply hysteresis to transitions, requiring more

successive readings in a lower state, say to drop from WARN back to INFO, as shown here, where successive transitions lead to different alert states
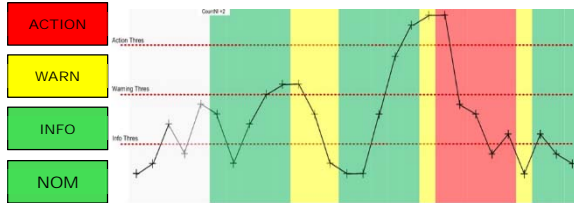

Doble PRIME IDD

The Doble PRIME IDD is a bushing monitor built on almost 20 years of field experience and practical value; papers at the International Conference of Doble Clients show examples where bushings, and consequently whole transformers, have been saved.

The Doble PRIME IDD measures the actual leakage current through the bushing tap, and measures the relative phase difference between the currents for each bushing in a set; voltage measurements will be recorded where available.
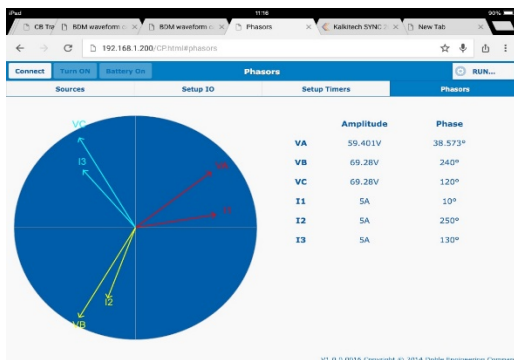
Voltage reference

A voltage reference allows the analysis of the leakage current magnitude to be made with the effect of voltage variation taken into consideration. If the voltage measurement is suitably accurate, a 'true' power factor for the insulation may be calculated – accuracy will depend on the Voltage Transformer system used. The diagram shows current and voltage phasors; raw data from individual waveforms is also recorded and a live 'scope' mode available for investigations.

Doble PRIME IDD Expert System and ASM

A configurable Expert System within the Doble PRIME IDD provides alert notification at INFO, WARNING and ACTION. However, as bushing failures can be rapid, there is no state transition delay or hysteresis – documented saves have shown that deterioration can lead to parameter changes within minutes. The Expert system learns the 'normal' condition of the parameters and provides alerts with respect to both current state and historic trends.

Doble PRIME Domino and Delphi DGA

Doble PRIME Domino gives continuous moisture in oil measurements while DGA gives continuous single value DGA readings. Alarms can be configured based on absolute level or on rate of change.

Analytics: Doble PRIME & Doble ARMS

Doble PRIME Analytics apply to single data sources such as a Domino, or a combination of sources – providing analysis capability no single device can offer. Doble PRIME will communicate seamlessly with Doble ARMS, feeding into a fleet wide, risk managed view of all assets.

Doble Expertise

More than any other company in the world, Doble experts have been dealing with issues in transformers and insulating fluids for over 80 years. Doble is always willing to help our customers with the equipment that we provide and interpretation of data from the Doble PRIME sensors.

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