ICM*flex* - Partial Discharge & tanδ Measuring Instrument

ICM*flex*

The ICM*flex* high voltage instrument family offers inherent operator safety and greatly simplifies distribution class cable testing and other field tasks involving partial discharge and tanδ testing. With the unique concept of the ICM*flex* instruments, the entire acquisition hardware is placed on high voltage potential right at the position where the signals are. Thus, no signal cables are needed, as the instrument is fully self-contained and battery operated. The instruments are fully remote controlled via high speed Bluetooth or fiber optic communication.

Unique Concept

The ICM*flex* instrument family is available with different options and for different voltage levels. Additionally, the self-contained ICM*flex* acquisition unit can be placed on top of any third-party coupling or reference capacitor. The option TD offers tanδ and power factor (PF) measurements. The option PD provides partial discharge measurements according to the IEC 60270, whereas the option LOC includes partial discharge location for power cables.

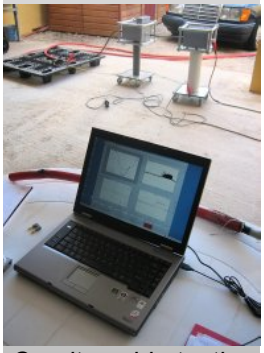
Wireless signal transmission via Bluetooth communication

Finally, the option TF covers a high voltage T-filter to sufficiently de-noise a high voltage supply for sensitive partial discharge measurements. The detachable Li-MH battery provides >8 hours of continuous operation, while a second battery is charged. Any high voltage AC source can be used including resonant test sets and VLF high voltage sources.

Testing distribution-class cables in a field environment becomes an easy and inherently safe task. The ICM*flex* unit is simply placed between high voltage source and the cable to be tested – no further leads required. The ICM*flex* unit can be equipped with a high voltage filter to accommodate noisy high voltage sources. Thus, with one unit requiring only high voltage and ground connection all essential measurements on laid power cable are performed in one step: tand, partial discharge, and partial discharge location.

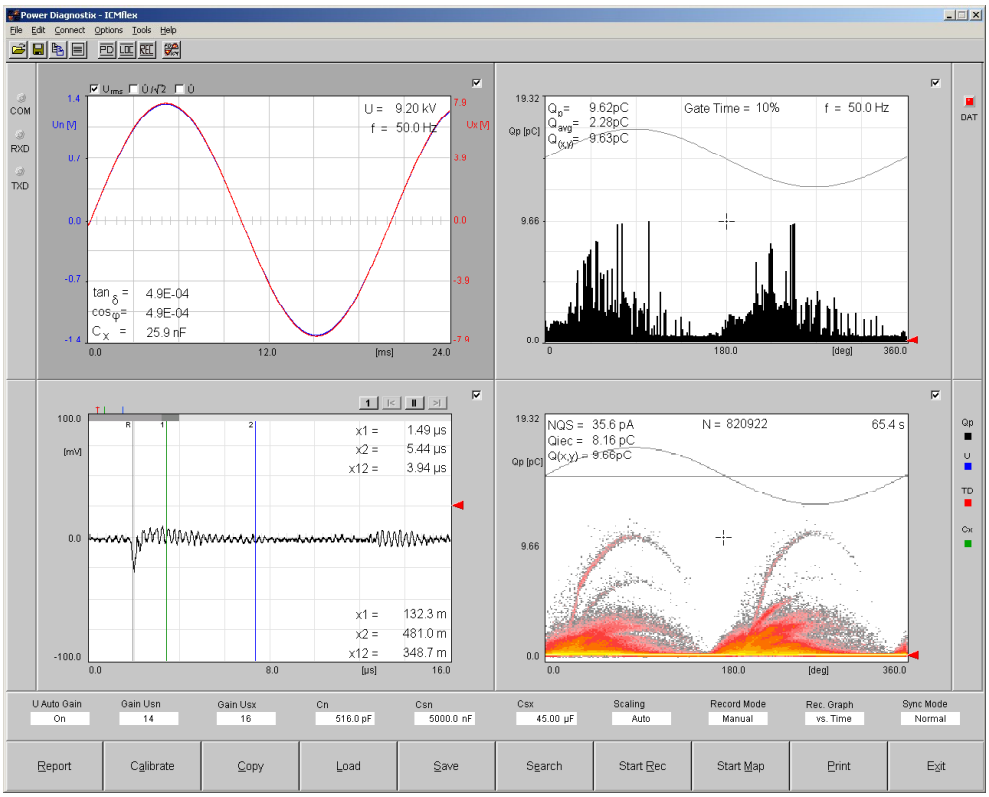
Off-line testing of generator and motor stator coils is simplified in the same way. Using any high voltage source, the critical AC measurements on the stator coil are done simultaneously: tanδ, PF, and partial discharge.

ICM*flex* & HV filter



On-site cable testing

TD measurement on motor bars



ICM*flex software*

Option TD
The tan delta analyzer uses an unbalanced bridge formed by internal shunt capacitors, the reference capacitor and the device under test. Here, the ICM*flex* software shows tanδ, PF, capacitance, voltage, and frequency.

Option PD
With the option PD the ICM*flex* software offers a meter display according to IEC60270 and an oscilloscopic display of the partial discharge activity as well as a colored *j-q-n* pattern (above) based on the data received via Bluetooth. Placing the quadrupole and acquisition unit on high voltage potential greatly improves the sensitivity and avoids any noise pickup on signal cables.

Option LOC
The partial discharge location option uses high speed (100 Msample) sampling of the PD pulses traveling the cable. Along with the analog bandwidth of 20 MHz this enables precise location and mapping of the discharge activity along the cable.

Using wireless Bluetooth or fiber optic technology the ICM*flex* tanδ and partial discharge analyzer family increases operator's safety and greatly simplifies off-line testing and analysis of distribution class cables and rotating machine stator windings.

Power Diagnostix Systems GmbH
Vaalser Strasse 250
52074 Aachen
Germany

Email: support@pdix.com
Web site: www.pdix.com
Tel: + 49 241 74927
Fax: + 49 241 79521

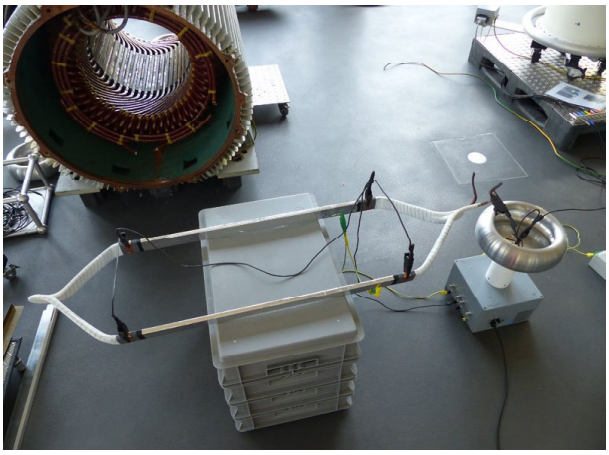
ICM*flex* GRC

In order to meet with the requirements of the existing IEEE 286-2000 and the new upcoming IEC 60034-27-3 standard for dielectric dissipation factor testing (also known as tanδ testing) on rotating machine stator windings and individual bars, Power Diagnostix made a re-design of the existing ICM*flex*, so called ICM*flex* GRC "Guard Ring Control".

Both standards mentioned above apply to rotating machinery with a rated voltage of 6 kV and higher and describe the test procedures and evaluation criteria for tanδ testing of individual stator bars and complete assembled stator windings. The testing as described applies to the common insulation system techniques in use, such as the resin rich and global vacuum pressure impregnated systems. However, the standards are not applicable for non-impregnated stator bars, also called green coils.

IEC 60034-27-3 ready

The main purpose of tanδ and tanδ tip-up testing is determining the overall condition of the stator winding or bar´s slot section also called ground wall insulation. The test results mainly show the performance in terms ionization losses versus the applied voltage of the ground wall insulation under the slot's conductive outer layer, acting as the ground electrode to the stator core.
Usually, the stator bars with a rated voltage of 6 kV and higher are provided of a field grading junction, consisting of a semi-conductive material, e. g. silicon carbide, at the slot-exit area in order to grade the surface potential were the stator bar leaves the grounded core. Depending on the rated voltage, this high resistance material with non-linear resistive voltage characteristic needs to be overlapped for a certain length with the slot's linear resistive layer applied to the ground wall. Based on such design, the tanδ measurement, which is intended for the ground wall insulation only, may be affected by the resistive losses of the field grading junction. For complete assembled stator windings the contribution of the losses generated by the semi-conductive material in the overall tanδ level cannot be neglected, and, hence, the regular ICM*flex* can still be used. However, as the evaluation criteria are specified for the slot section of individual bars only, guarding techniques shall be applied in order to minimize the influence of the field grading junction's losses on the overall tanδ value.



Stator bar testing with ICM*flex* GRC

Several techniques have been studied during the past such as the foil wrap methods and the slot-end gap method. Nowadays, with automatized bar manufacturing processes, it is practically not feasible to make an interruption at the slot end to apply the semi-conductive material after the tanδ test, since this will cause tremendous delays and, in worst case, essential failures affecting the integrity of the insulation system. Besides this, both standards recommend performing the measurement on the end product, i. e. the individual bar provided with the field grading junction, and, hence, using both techniques as mentioned above are not an option. The only technique left is the driven guard method.

The new GRC (Guard Ring Control) option provides such driven guard inputs on the ICM*flex*' digital tanδ bridge. Beside this new feature, the instrument still keeps its versatility by enabling the simultaneously updated partial discharge and tanδ measurement results with the highest precision. This flexible unique concept strongly reduces the (re)winding and testing times in rotating machine manufacturing companies and service groups and can even be used in quality assurance labs for non-destructive evaluation of the ground wall performance of individual stator bars.

The ICM*flex* GRC is optimized for the capacitance range of stator bars and for smaller asynchronous indication motors up to Roebel bars for larger synchronous turbo generators.

Furthermore, the embedded voltage divider for up to 30 kV_{RMS} comes with a DAkkS (former DKD) calibration certificate. The instrument is battery operated (up to ten hours) and equipped with a fiber optic link for communication with the computer via USB. The ad-vanced software provides manual and automatic record modes, even a step-by-step guidance structure with customized report after completing the test sequence. The data tables, phase resolved PD patterns, different charts, and graphs can be exported into common text and spreadsheet processing packages such as MS Excel.

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