

TESTHOTNEWS

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A New Approach for Analyzing Moisture in Paper and Pressboard of Power Transformers

Power transformers are critical, capital-intensive assets for utilities and industry. Transformers are extremely reliable; however, many of them in use today have already exceeded their design life. Today, transformers are not automatically replaced when they have reached the end of their designated life span, but are left in service for as long as possible.

Power transformers are often operated at or above their rated power. This accelerates the ageing process of the inner insulation, particularly the insulation paper, which cannot be easily replaced.

Investment in new transformers has to be planned in advance, because big transformers cannot be bought off the shelf. For a systematic replacement program to be planned, and to avoid unexpected breakdowns, diagnostic tools are becoming more and more important.

A very critical condition parameter is the water content in the solid part of the insulation (paper, press-board). It ingresses from the atmosphere and further accelerates the deterioration of the cellulose through de-polymerization. In addition, increased water content in oil may cause bubble formation and lead to a sudden electrical breakdown.

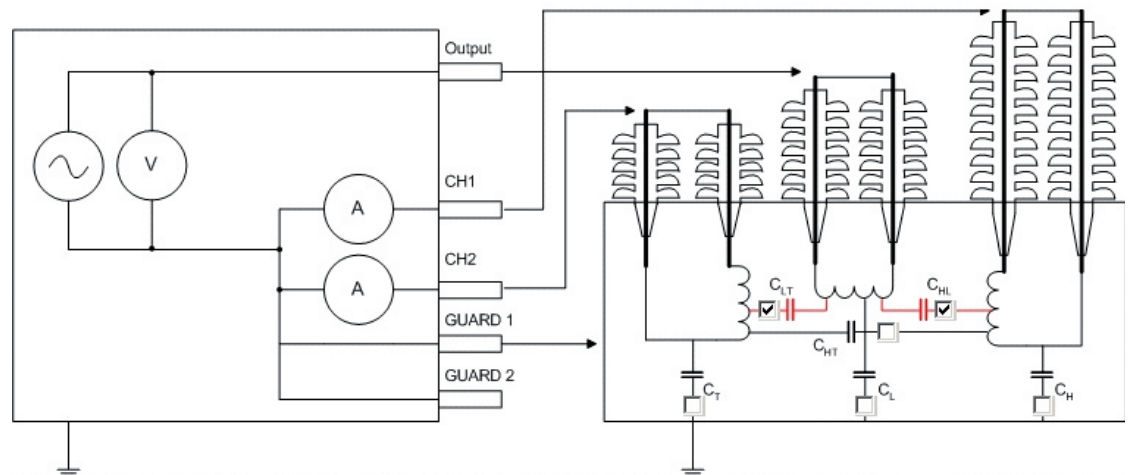
Two dielectric response measurement techniques have become established. The current measurement in the time domain, also called the Polarization

and Depolarization Current (PDC) method and the Frequency Domain Spectroscopy (FDS). Both of these can be compared by transforming the results from the time domain into the frequency domain or vice versa.

Particularly for low frequencies, the PDC method is much faster than FDS but delivers reliable results only up to about 1 Hz. FDS can be applied for all useful frequencies, but requires long measuring times at low frequencies.

The new OMICRON Dielectric Response Analyzer DIRANA combines the advantages of both methods. The FDS measurement is used down to 0.1 Hz where it can be done with a short testing time. The FDS results for lower frequencies are calculated from the PDC values. This reduces the measurement time to about a quarter of the FDS measuring time. Additionally the two measurement channels allow two insulation gaps to be measured at the same time.

Aged transformer oils often have increased values of conductivity through acids and other aging products. This can lead to incorrect water content results. The improved insulation model in the DIRANA software compensates for this influence.



Simultaneous measurement of the capacitances C_{HV-LV} and C_{LV-TV} with the OMICRON DIRANA

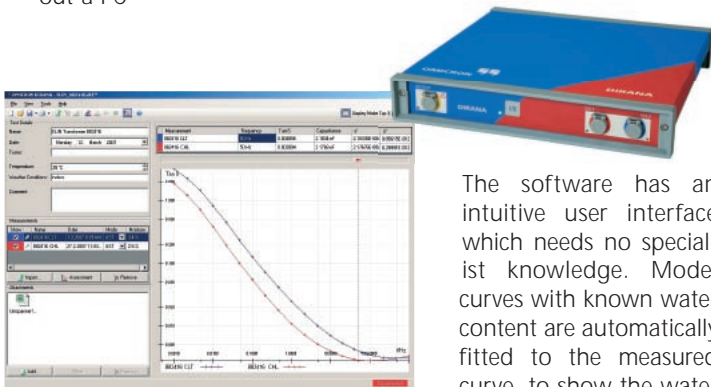
The New OMICRON Dielectric Response Analyzer DIRANA

The DIRANA is a patented device which determines the content of water in insulations. It features two different high-precision measuring instruments: a two-channel pA meter for Polarization and Depolarization Current (PDC) measurements and a capacitance and Dissipation Factor (DF) measuring instrument for Frequency Domain Spectroscopy (FDS), which is capable of measuring at frequencies between 0.1 mHz and 5 kHz.

Normally measurements from 5 kHz down to 0.1 Hz are done using FDS whereas measurements from 0.1 Hz down to 1 mHz, or even 0.1 mHz, are made with PDC. The PDC results are transformed into the frequency domain automatically during the measurement, to show all results as dielectric dissipation factor over the frequency (FDS). This way a complete test from 5 kHz down to 1 mHz can be completed in less than 20 minutes. Two measuring channels enable a simultaneous measurement of two insulation gaps, such as HV to LV winding and LV to tertiary winding. In contrast a measurement of two gaps with a single-channel FDS instrument down to 1 mHz, would take about 2 hours.

Benefits

- Short measuring time: reduces the outing time and the measuring effort to a minimum
- The built-in expert knowledge: makes measurements easy even for non-specialists
- Very small and light-weight device: makes transportation and handling easy
- The improved insulation model: provides reliable results for new and aged transformers
- The flexible curve presentation: allows the PDC results to be displayed either as FDS or PDC curves
- Display of C-tan-delta values for 50/60 Hz: enables the comparison to conventional C-tan-delta measurements
- The advanced import function: allows the importation of external PDC and FDS results and their analysis with the DIRANA software
- The built-in processor: makes it possible to run the DIRANA without a PC

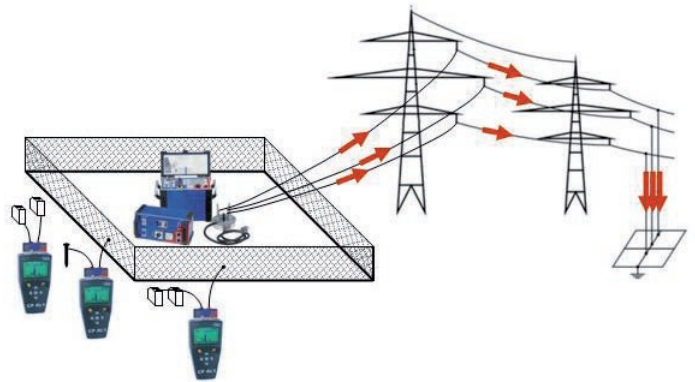


Display of the results in the frequency domain

can be used for measuring the dielectric response of any HV insulation. This can include: oil impregnated paper (OIP) insulated cables, resin bonded paper (RBP), resin impregnated paper (RIP) and OIP high-voltage bushings plus generator and motor insulation.

Step and Touch Voltage Measurement Using the CPC 100, the CP CU1 and the New CP AL1

The safety of utility staff and the public, requires electrical plants to be properly installed and commissioned in accordance with the applicable standards. Careful planning and dimensioning of grounding systems is of particular importance in order to achieve this. Appropriate inspection must be performed during commissioning and at regular intervals during normal operation, in order to ensure the proper condition of the grounding system (e.g. grounding system inspection according to IEEE 80-2000, BS 7354 or DIN VDE 0101).



Touch voltage measurement using the CP AL1, CPC 100 and CP CU1

In most cases, step and touch voltage measurement is performed by feeding a current into a remote grounding system via an overhead line or cable, in order to create a potential gradient. The touch voltages can then be measured at the substation fencing or at other points accessible to people.

Until now, such measurements were performed at, or close to, the mains frequency. This required very expensive measures to suppress interference using the beat method or the phase reversal method as interference is not necessarily constant with regard to time.

Using the CPC 100 in conjunction with the CP CU1, it is possible to generate and inject a range of frequencies to the lines. These frequencies can be easily measured at the test point using the new Fast Fourier Transformation (FFT) Volt meter CP AL1.

The specified testing resistors for body and shoe resistances, as defined in the standard, are already integrated in the connection adapter of the CP AL1, therefore facilitating the measurement procedure. Footprint electrodes conforming to the standards are also available. Since these electrodes must have a weight of 25 kg, they are designed as water containers. This way, it is possible to fill them on-site which makes transport easy.



CP AL1 with adapter

New Test Universe Version 2.20

The new Test Universe version 2.20 will be available from autumn 2007. In addition to many detail improvements, this version will provide the following new features:

Compatibility: TU 2.20 will be fully compatible with Microsoft Windows Vista.

PQ Signal Generator: This new module allows the generation of continuous sequences of waveforms representing typical conditions which affect the quality of the power supply as defined by power quality standard IEC 61000. It can be used to test power quality monitoring devices or to directly feed low-voltage terminal equipment (e.g. using an amplifier CMC 252 for loads with up to 1000 W).

TestBase Standard: A Personal Edition of this testing database from OMICRON, that allows the user to manage test object data and test results, is delivered together with TU 2.20 (when the package includes the OMICRON Control Center - OCC) and can now be accessed from the TU Start Page.

Protection Testing Library: The TU Start Page will provide access to the collection of test templates provided for standard relays.

Sampled Values Configuration: This module configures, enables, or disables the sampled values output of a CMC test set with NET-1 Option.

The sampled values are generated according to the "Implementation Guideline for Digital Interface to Instrument Transformers using IEC 61850-9-2", published by the UCA International Users Group.

Overcurrent Characteristics Grabber: A digitizing utility to capture inverse time characteristics from graphical representations, for use in the Overcurrent module.

OMICRON News: If desired, and if access to the Internet is available, Test Universe informs you about the latest news and product updates (e.g. availability of new test templates).

Tutorials: Tutorial video clips introduce the use of Test Universe.

New feature in Ramping module: Ramping of a superimposed harmonic as a second signal component.

New feature in the OMICRON Control Center: Easier handling has been achieved through the hierarchical grouping of modules.

New feature in QuickCMC: The timing function can now be triggered by an interruption in the current circuit supplied by the CMC. This will facilitate measurements such as circuit breaker operating time.

Time synchronization: These settings are now stored for each test module in the OCC and enable the use of relative start times ("next full minute"). This helps to facilitate end-to-end testing using two remote test sets, without user interaction.

Further improvements have been made in other modules such as Advanced Differential, Overcurrent, Meter, Harmonics, Transducer, Annunciation Checker and Polarity Checker.

This software version will be available on CD and for download in the customer area of our website. The update of your existing licensed modules of a previous TU version 2.x is free of charge. For software of version numbers 1.x an upgrade or update must be paid – prices are available on request. The TestBase software, the Protection Testing Library and the Overcurrent Characteristics Grabber delivered with this version are free of charge. For the new modules PQ Signal Generator and Sampled Values Configuration, it is necessary to purchase separate licenses, if required. All previous license data remain valid with the new software version.

Maintenance Management with TestBase 2.0

Engineers and technicians who are responsible for the commissioning, maintenance and repair of power system components face numerous challenges. Furthermore, a multitude of information is necessary to perform their daily work and this is usually to be found in different sources.

TestBase is a technical database system developed by OMICRON, which enables the easy management of all information relating to power system components. The data collected in this database can be automatically transferred to the test templates of test equipment such as the CPC or CMC.



In future, when a CPC or CMC is purchased, OMICRON will deliver the Personal Edition of TestBase free of charge together with CPC Explorer 1.4 SR7 or the Test Universe 2.20 (for packages including the OMICRON Control Center - OCC). This edition includes:

- A database based on the Microsoft SQL Server for standardized input, management, evaluation and storage of data
- An intuitive and easy to use graphical user interface
- The management of all kinds of documentation (e.g. photographs, network plans, manuals, other test templates etc.)
- All OMICRON Protection Testing Library (PTL) models and test templates, allowing data transfer from the relay to the OCC test template via TestBase
- CPC 100 test templates allowing TestBase data transfer. The corresponding Excel File Loaders are started and filled in automatically

Upgrading TestBase provides many new powerful features:

- Simultaneous and mobile access of an unlimited number of computers and notebooks (clients) to the database; easy data synchronization with the central server
- Extended management of any operating components on the power system
- Definition and monitoring of test cycles with the maintenance planning module
- Management of all network disturbances and events data
- Automatic generation of a large number of diverse reports
- Interfaces to other database systems

