

DRYmon

Drying process monitoring system
for oil-paper insulation



Dry insulation is good insulation

Why you should keep oil-paper insulation at just the right level of dryness

Accumulated water in the oil-paper insulation of your power transformers significantly reduces its life expectancy and can lead to premature failure. Therefore, water should be reduced to acceptable levels at the end of the manufacturing process and also after repair.

Drying directly after manufacturing

The optimal water content in the solid insulation of a newly-manufactured transformer is targeted at a maximum of 0.5%, for the following reasons;

- > water leads to an accelerated aging of cellulose, as hydrolysis degrades the paper and pressboard
- > a product of hydrolysis is additional water leading to a snowball effect, i.e. the more water the faster the aging

Therefore, dry transformers will age significantly slower than wet transformers.

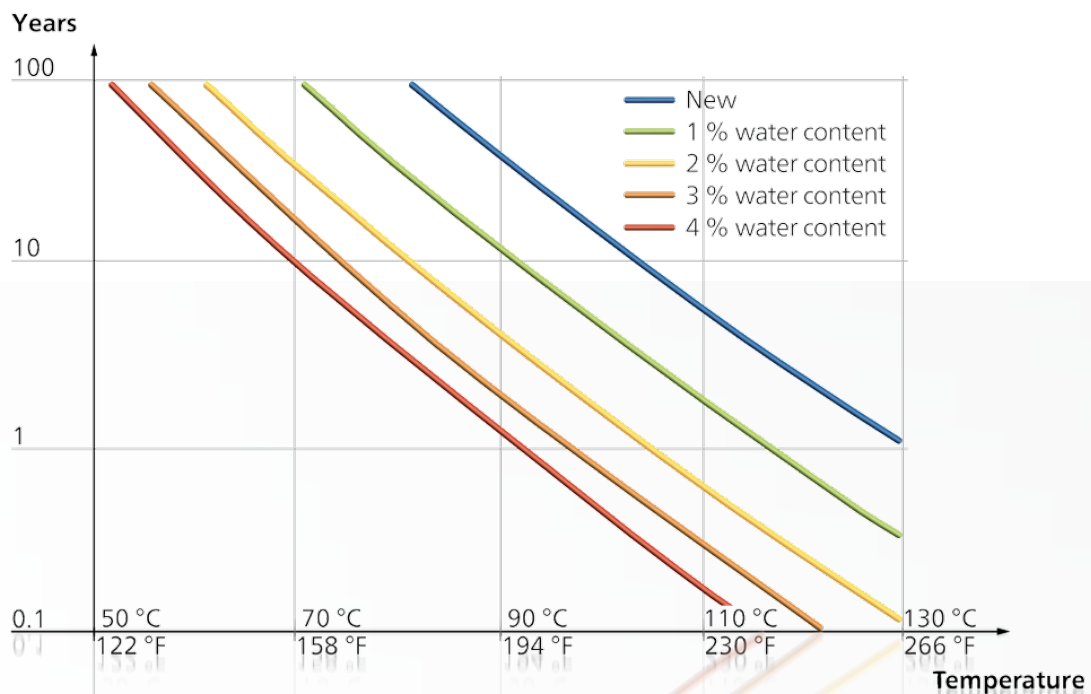
Drying after maintenance and repair work

Also during maintenance and repair work, water can penetrate the insulation. In an opened transformer the water content of the active part increases rapidly, especially for oil-free pressboard and under high temperatures due to the hygroscopic effect.

- > An increase of water content by 1 % cuts life expectancy by half.
- > A temperature increase of 8 °C / 14.4 °F cuts life expectancy by half.

Therefore, drying of your transformers after each maintenance or repair task will help you increase their life expectancy.

Transformer life expectancy



Source: Lundgaard et al.: Aging of oil-impregnated paper in power transformers; IEEE Transactions on Power Delivery, Volume 19, Issue 1; Jan. 2004, pp. 230-239

Why drying process monitoring

Drying – for example in a vacuum oven – is a very time-consuming process.

To date, real-time monitoring of the drying process directly at the insulation was not possible. Therefore, the duration of the drying period has often been based on the personal experience and opinion of the operators.

Real-time monitoring of the drying process helps you optimize the drying time, resulting in consistent insulation quality.

How DRYmon works for you

OMICRON's DRYmon is the world's first measuring instrument using dielectric response analysis for monitoring the complete drying process of your oil-paper insulation in real time.

With DRYmon you can monitor all transformer sizes and all offline drying methods such as

- > hot air process,
- > vapor phase process,
- > hot oil spray method,
- > low frequency heating.



Intuitive software user interface

Easy-to-use software with real-time display of water content.

Direct measurement

Real-time monitoring of water content via direct measurement of the transformer insulation.

Rack-mountable design

For easy integration into your existing drying equipment.

Drying process monitoring with DRYmon

1 Innovative monitoring method

DRYmon directly measures the capacitance and dissipation factor of the interwinding insulation between high and low voltage over a wide frequency range.

The resulting graph of power factor / dissipation factor over frequency is called dielectric response.

The water content and temperature influence the measured response. Therefore, DRYmon always determines the actual insulation temperature before starting each measuring cycle. This automatically eliminates potential deviations in the measurement curves resulting from temperature changes during the drying process.

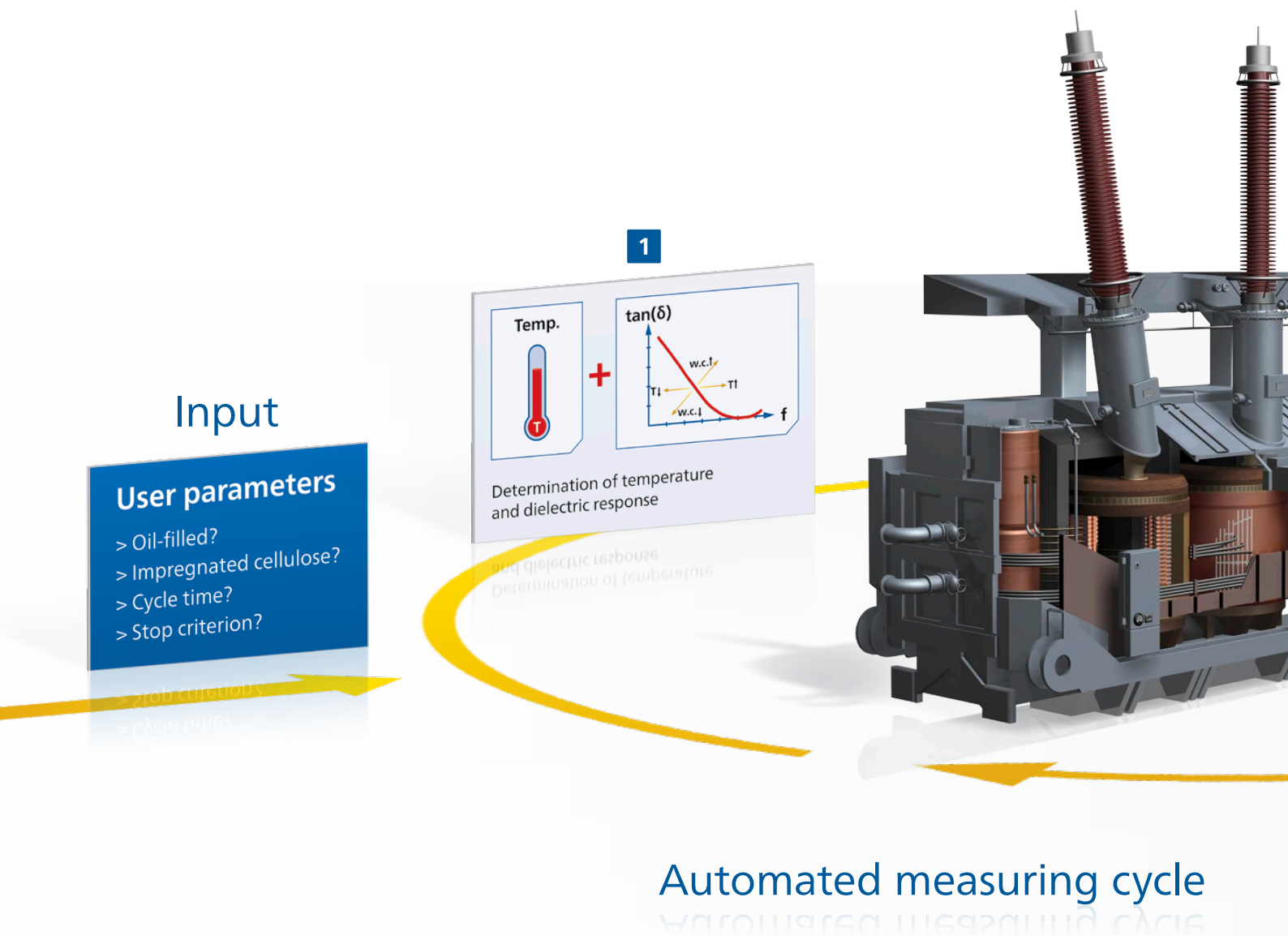
2 Powerful database for accurate results

After each measurement, the DRYmon software automatically compares the measured curve with modeled curves. The modeled curves are calculated using highly accurate data from the integrated database.

As a result you get high-accuracy, real-time information about

- > the water content in the solid insulation (before and after oil-impregnation),
- > the oil conductivity (if oil-filled).

The accuracy of the measuring results is comparable with the Karl Fischer Titration method.

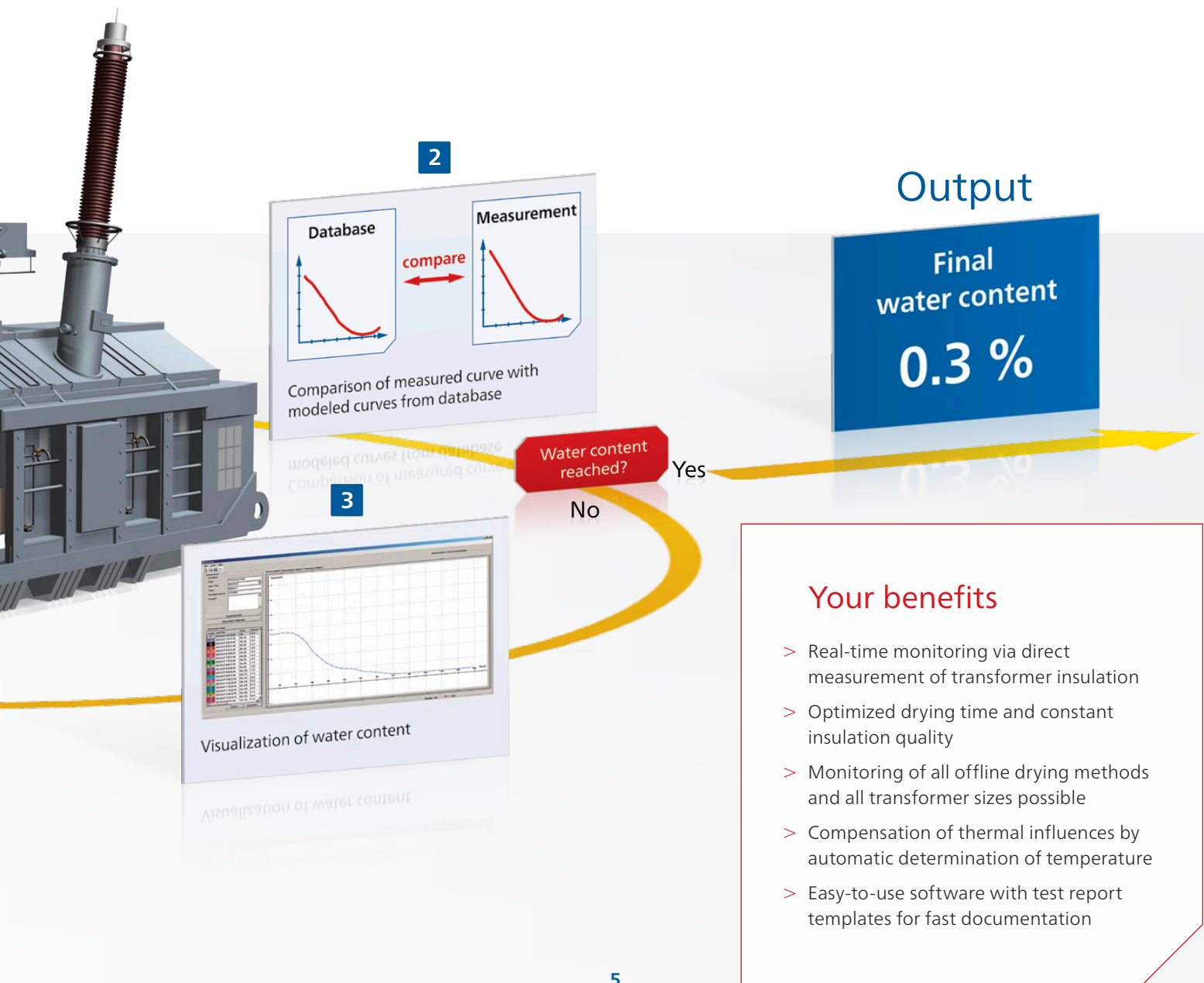


3 Automated process with easy-to-use software

DRYmon is equipped with a very intuitive user interface and its measuring cycle provides you with a high degree of automation. As a result, you can easily monitor the drying process in real time and without expert knowledge.

The water content is checked after each measuring cycle and the cycle is repeated until the final content is reached. An alert will indicate the end of the cycle.

Integrated protocol templates support you with a fast and sustainable documentation of your drying process.



Ordering information

DRYmon Standard Package (order no. VE000672)

Necessary standard package for all drying methods. For **in-tank drying methods**, such as **hot oil spray** or **low-frequency heating**, DRYmon can be directly connected to the transformer. No further accessories are needed.

Package components

- 1 × DRYmon
- 1 × Discharge box
- High-temperature measurement cables BNC-BNC (12 m / 39 ft)
 - > 2 × red, 2 × blue, 2 × black, 4 × yellow
- 2 × High-temperature Kelvin clamp
- 6 × High-temperature measurement clamp
- 1 × USB cable
- 1 × DRYmon software

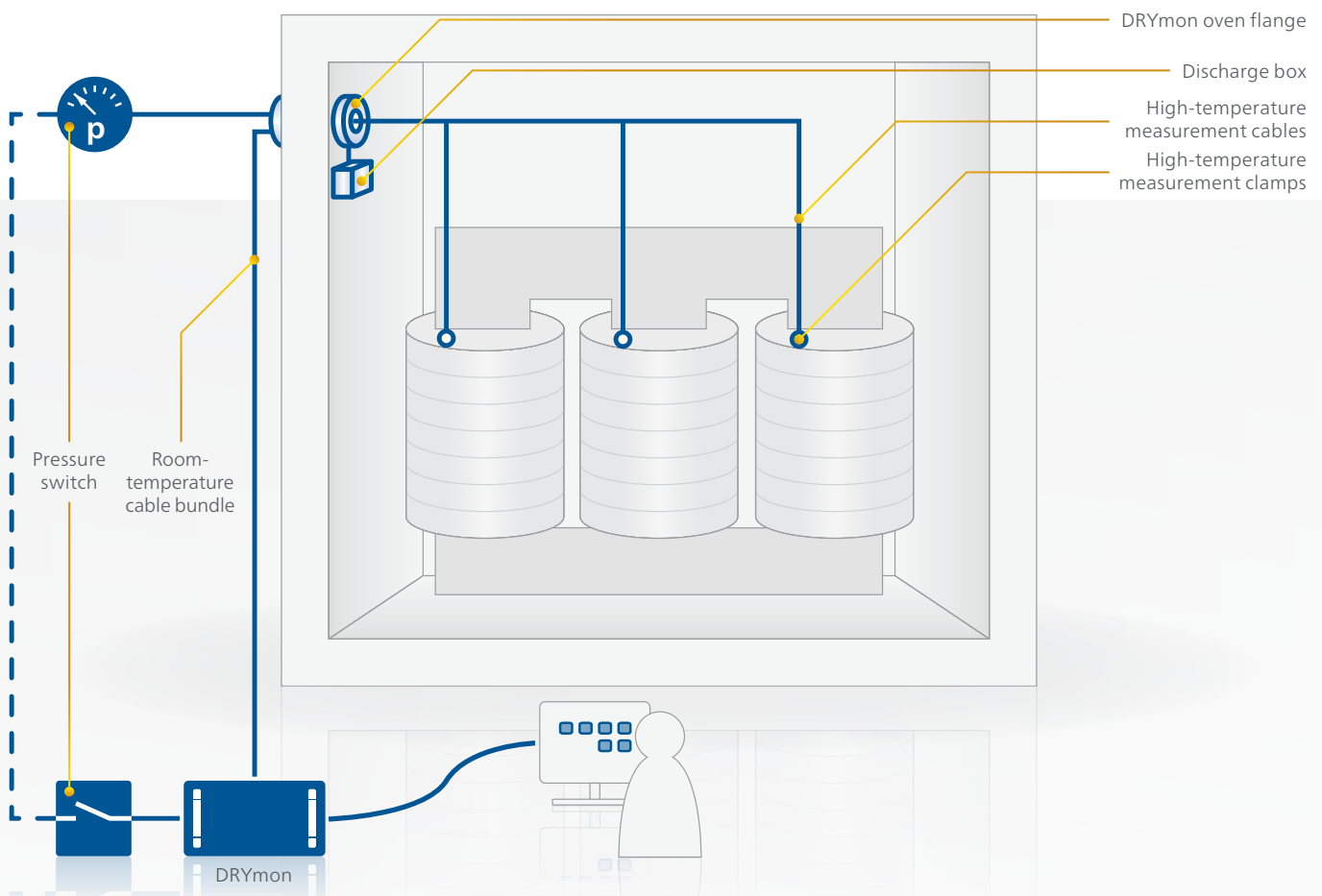
DRYmon Vapor Phase Upgrade Option (order no. VEHZ0615)

Special accessories which are additionally necessary for **vapor phase drying**.

Package components

- 1 × Pressure switch (ATEX certified)
- 1 × Room-temperature measurement cable bundle (10 × BNC-BNC, 5 m / 16 ft)
- 10 × BNC adapter

Usage of package components and accessories



DRYmon accessories and spare parts

For **oven drying** an oven flange and the room-temperature measurement cable bundle are additionally necessary.

Description	Order no.
1 × DRYmon oven flange (DN150)	VEHZ0631
1 × DRYmon oven flange (DN250)	VEHZ0632
1 × DRYmon oven flange (special)	VEHZ0633
High-temperature measurement cables BNC-BNC (12 m / 39 ft)	
> 1 × red	VEHK0671
> 1 × blue	VEHK0672
> 1 × black	VEHK0673
> 1 × yellow	VEHK0674
1 × Room-temperature measurement cable bundle (10 × BNC-BNC, 5 m / 16 ft)	VEHK0675
1 × High-temperature Kelvin clamp	VEHZ0634
1 × High-temperature measurement clamp	VEHZ0637
1 × Discharge box	VEHZ0638



Specifications

Process-related

Type of applicable paper insulation	oil-impregnated and non-oil-impregnated
Range of measurable water content	0.3 % ... 5.5 %

Output

Maximum measurement voltage	200 V _{peak}
Maximum output current	5 A _{peak}

Dissipation factor and capacitance

Dissipation factor range, resolution, accuracy	0 ... 10, 10 ⁻⁵ , 2% + 5 × 10 ⁻⁴
Capacitance, accuracy	10 pF ... 10 μF, 0.5% + 1 pF
Frequency range	0.05 mHz ... 1 kHz, selectable

Mechanical data

Dimensions (W × H × D)	483 × 221 × 529 mm 9.0 × 8.7 × 20.8 inch
Weight	18.6 kg / 41 lb

Power supply

Input voltage	100 V ... 240 V
Frequency	50 Hz ... 60 Hz

Maximum operating temperature of oven accessories

Temperature for cables and clamps	150 °C / 302 °F
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OMICRON is an international company serving the electrical power industry with innovative testing and diagnostic solutions. The application of OMICRON products allows users to assess the condition of the primary and secondary equipment on their systems with complete confidence. Services offered in the area of consulting, commissioning, testing, diagnosis and training make the product range complete.

Customers in more than 140 countries rely on the company's ability to supply leading-edge technology of excellent quality. Service centers on all continents provide a broad base of knowledge and extraordinary customer support. All of this together with our strong network of sales partners is what has made our company a market leader in the electrical power industry.

For more information, additional literature, and detailed contact information of our worldwide offices please visit our website.