

# DIRANA

The fastest way of moisture determination of power and instrument transformers and condition assessment of rotating machines



# DIRANA – the fastest way of dielectric

## Moisture reduces the lifetime of transformers

For power transformers, the moisture content is one of the most important parameters determining the remaining lifetime. Moisture in oil-paper insulated power and instrument transformers is caused by paper aging or enters the transformer via leaky seals or breathing. It leads to a reduced breakdown strength and an accelerated aging of the insulation.

Knowing the moisture content enables you to perform condition based maintenance which reduces failures and avoids unnecessary replacements. Additionally, it also allows you to verify if a new transformer is really dry.

## Automatic and easy moisture analysis

DIRANA determines the water content in paper without the need of oil sampling. It combines Frequency Domain Spectroscopy (FDS) and Polarization Depolarization Current (PDC+). In combination with the automated frequency range setting, DIRANA ensures the shortest measurement time on all assets at any temperature. The easy to use software provides automatic analysis and requires no expert knowledge.

# moisture analysis

## Applications

With DIRANA you can analyze the water content in different kind of cellulose insulation. You can test assets filled with mineral oil, natural and synthetic ester as well as air or vacuum. Commonly tested assets are:

- > Power transformers
- > Instrument transformers
- > Bushings

Additionally, dielectric measurement is available for diagnosis of other types of assets, such as:

- > Rotating machines
- > RBP, RIP and RIS bushings
- > Cables

## One measurement – many valuable results

A single DIRANA measurement does not only provide you with the water content and oil conductivity of the asset, but also delivers many more valuable parameters such as:

- > Power/dissipation factor at line frequency
- > Capacitance
- > Insulation resistance
- > Polarization index (PI), DAR...

## One box for easy and comfortable testing

With DIRANA you get all the required components in just one box. This makes testing quite comfortable and the system easy to transport. Its simple wiring and concept clamps with integrated guard connections make setting up tests easy and fast.



## Your benefits

- > Non-invasive moisture determination in the paper insulation
- > Automated software for easy analysis without expert knowledge
- > Shortest measurement time by combination of revolutionary FDS and PDC+ and automatic frequency range determination
- > Applicable to all oil-paper or ester-paper insulated assets
- > Compact all-in-one test set

 [www.omicronenergy.com/DIRANA](http://www.omicronenergy.com/DIRANA)

# Dielectric frequency response (DFR) analysis

## How does DFR work?

The main amount of cellulose insulation in the active part of a transformer is located between the primary and secondary winding. To measure this insulation, the output is connected to the high-voltage winding and the input to the low-voltage winding. Unwanted capacitive and resistive currents are bypassed by the guard connection which is applied to the tank.

The power dissipation factor of the insulation is measured over a wide frequency ranging from the  $\mu\text{Hz}$  to the kHz region. The resulting curve contains information about the insulation condition.

The very low frequencies contain information on moisture in the solid insulation, while the position of the slope in the mid-range frequencies indicates the conductivity of the liquid insulation. This curve is automatically compared to model curves and the moisture content of the cellulose insulation is calculated.

The method is scientifically approved by CIGRÉ. There are no other non-invasive ways to assess moisture in a transformer which provide comparable accuracy.



DIRANA determines the moisture content of oil-paper insulated power and instrument transformers and also assesses the condition of bushings by using dielectric response analysis.

## Result analysis and assessment

A DFR measurement doesn't only provide you with a power/dissipation factor value at line frequency with comparable accuracy to a high-voltage test set. It also enables you to determine if a high value is caused by water, bad oil and the bushings or if further factors such as soot, corrosive sulphur or localized carbonized spots may be the cause.

The assessment is performed in accordance with IEC 60422 which provides categories for moisture levels.

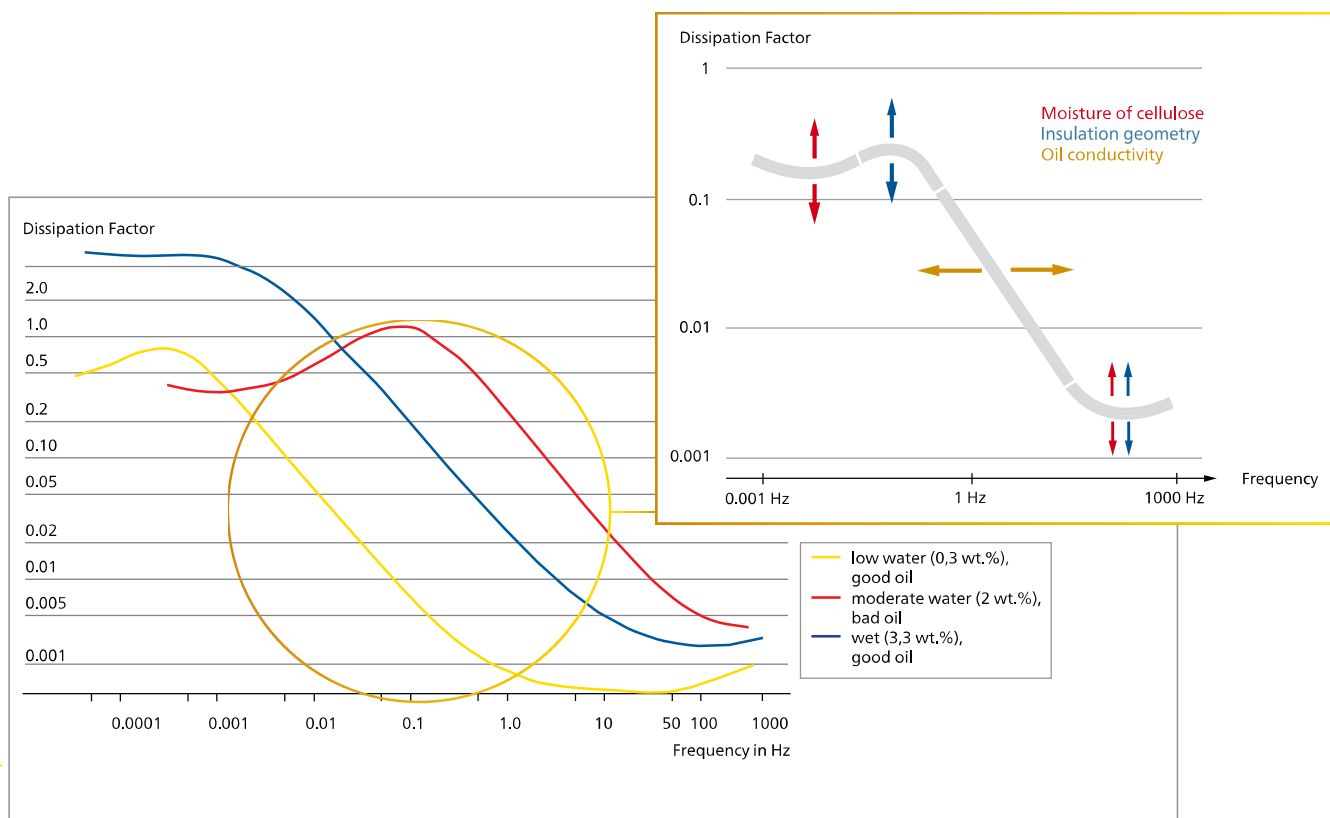
DIRANA is the only device which compensates the influence of aging byproducts. Otherwise this would lead to an overestimation of the water content in aged transformers.

## Combining advantages

DIRANA uses the two measurement methods FDS and PDC+ and combines their advantages:

Frequency Domain Spectroscopy (FDS) is fast and accurate in the high frequency range up to 0.1 Hz but slow at low frequencies.

Time domain spectroscopy via Polarization Depolarization Current (PDC) measurement uses a DC step to measure all frequencies at once but can only be used for rather low frequencies. PDC+ is an advanced version of the PDC measurement which provides much shorter measurement times and offers improved noise immunity. DIRANA uses FDS to cover the high frequency spectrum and PDC+ for a test measurement of frequencies below 0.1 Hz.



The dielectric response curve allows conclusions to be drawn about the different factors that influence the measurement result.

# Innovative measurements with DIRANA

## The shortest measurement time – always

The patented principle of combining FDS for high frequencies and PDC+ for low frequencies enables testing over a wide frequency range in an extremely short time.

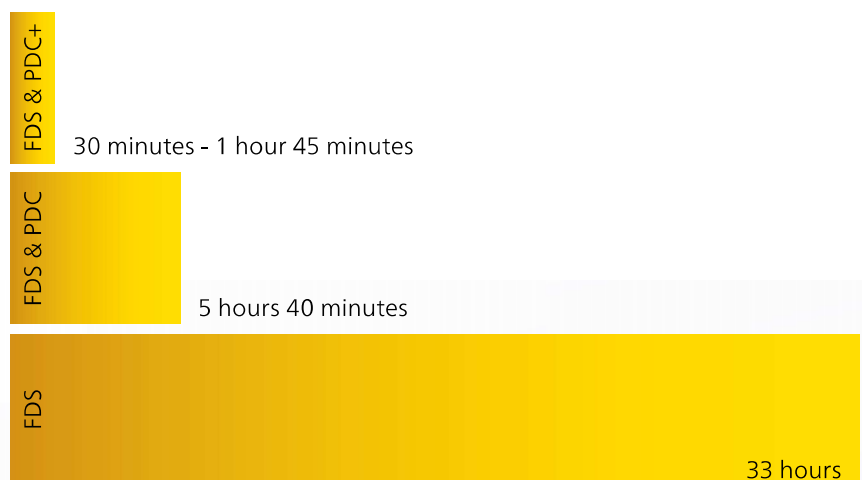
Thereby, DIRANA's unique technique ensures that exactly the required frequency range is measured, not more and not less. DIRANA determines all test parameters automatically and individually for each measurement so you don't need special expert knowledge to work with DIRANA.

Once the parameters are known, the required measurement time is updated automatically.

Where conventional FDS measurements take more than a day to measure from 1 kHz to 10  $\mu$ Hz, DIRANA can achieve this in 30 minutes to 1 hour 45 minutes.

## Lowest testing frequency in the market

Due to DIRANA's innovative measurement concept you can perform high precision measurements down to 10  $\mu$ Hz which is the lowest frequency range available for transformer analysis. This ensures accurate measurements for all assets, even new transformers with very low oil conductivity or an empty tank.



Test time for frequency sweep from 1 kHz to 10  $\mu$ Hz



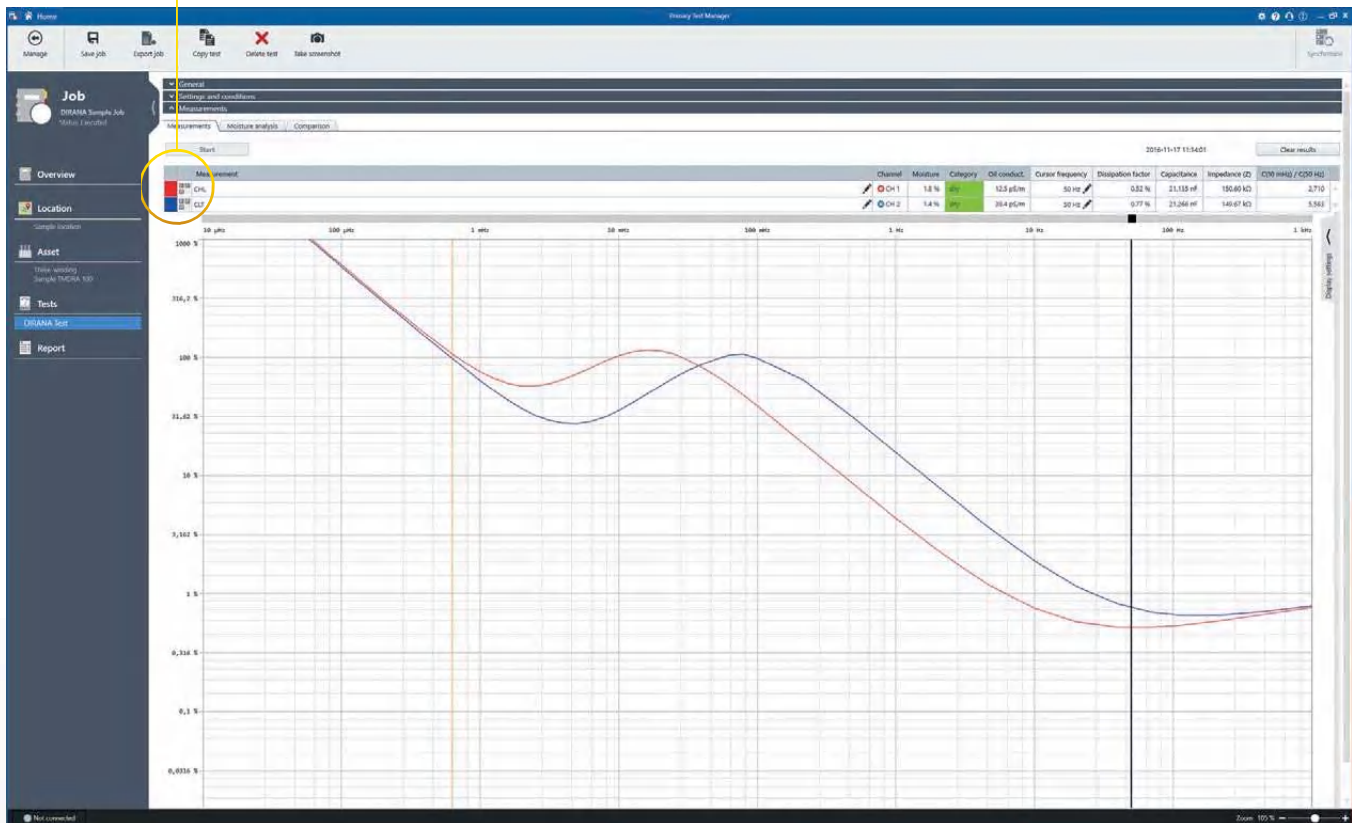
## Reliable assessment

DIRANA uses a scientifically proven method to determine the moisture content. The comparison of the measurement to a built in database is performed completely automatically by the software, you only need to enter the oil temperature value.

The automated assessment function compensates for influences such as temperature, insulation geometry, oil conductivity and aging byproducts.

Thus, DIRANA reliably detects moisture even in aged oil-paper insulation. The automatic evaluation is conducted according to national, international or user defined standards.

Measurement	Channel	Moisture	Category	Oil conduct.	Cursor frequency	Dissipation factor	Capacitance	Impedance (Z)	C(10 mHz) / C(50 Hz)
CHL	CH 1	1.8 %	dry	12.5 pS/m	50 Hz	0.52 %	21.135 nF	150.60 kΩ	2,710
CLT	CH 2	1.4 %	dry	39.4 pS/m	50 Hz	0.77 %	21.266 nF	149.67 kΩ	5,583



DIRANA measurement of a power transformer including automatic assessment of moisture content and oil conductivity.

# Step by step through the test procedure with Primary Test Manager™

DIRANA is operated by the Primary Test Manager™ (PTM). It is the ideal software tool for the diagnostic testing and condition assessment of your power and instrument transformers.

## Management of location, asset and test data

PTM provides a well-structured database for managing not only DIRANA data but all electrical and chemical transformer test results to get a comprehensive overview of your asset's condition.

You can define and manage locations, assets, jobs and reports in an easy and fast way. All electrical transformer tests can be configured, executed and managed within PTM.

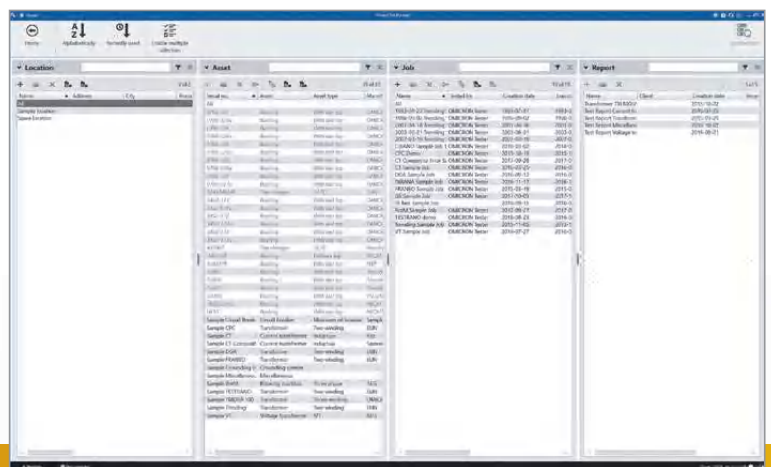
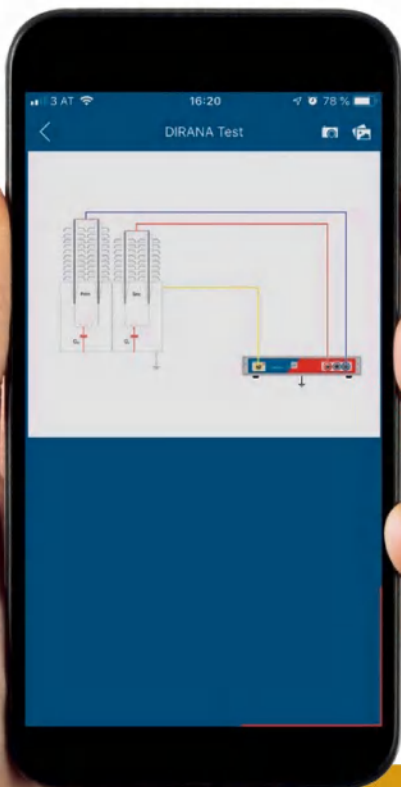
## Import and export functionality

You can easily import all measurements performed and stored with the previous DIRANA software to the new PTM database. In addition, PTM data can be filtered or exported in common formats.

## Data synchronization and back-up

With the 'PTM DataSync' module, you can synchronize your local database with a PTM server database. The server database collects the test data from every user connected to the server. Thus, data synchronization and storage are safer and more convenient than they have ever been before.

Get the PTMate app free of charge in the App Store and Google Play Store!



Easy management of location, asset and test data due to a structured database, implemented search and filter functions and automatic data synchronization.



# (PTM)

## Easy connection and operation

From the information on the asset's nameplate data, the optimal measurement setup is derived. Pre-configured wiring diagrams assist you with setting up the test equipment in the correct manner.

This minimizes the likelihood of measurement errors and speeds up your testing process.

### One button test

As DIRANA automatically sets all relevant parameters, it takes just one button to press to start the whole measurement and get the results.

### PTMate app – your mobile companion

PTMate is our mobile companion for PTM. The app supports you on site and extends the PTM feature set to your smartphone, such as easy data entering, fast and safe wiring for tests as well as a stop button for ongoing measurements.

## Result analysis and reporting

DIRANA automatically performs the moisture and oil analysis once the test is finished. The results are then categorized according to national or international standards or to custom settings.

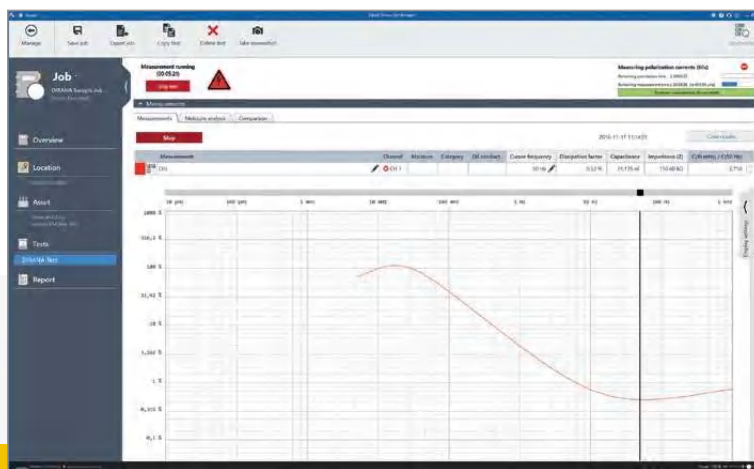
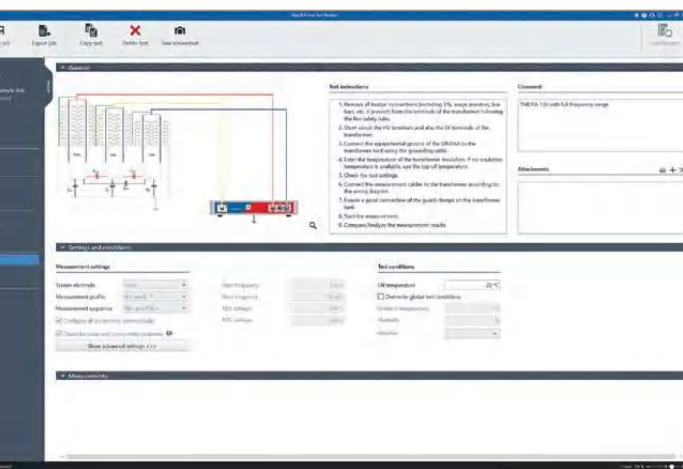
### Comparison tools for detailed analysis

For a detailed analysis you can view different test results side-by-side in one diagram. You can compare test results to previous measured data of the same asset as well as to measurement data of other assets.

### Customized, individual reports

PTM can automatically generate reports for DIRANA and any further measurements for example, SFRA, leakage reactance, excitation current or winding resistance. This gives you a comprehensive overview of your power and instrument transformer, its test results, and its assessment.

You can easily adapt the reports to your needs for example, compile the included parts, provide comments or incorporate your company logo.



PTM supports you in the best possible way during execution of diagnostic tests via wiring diagrams and asset-specific test plans according to international standards.

For a comprehensive analysis, PTM offers automatic result assessment and comparison as well as customized reporting.

# Technical data and ordering information

## Technical data DIRANA

### Voltage source

Measurement voltage	200 V <sub>peak</sub>
Maximum continuous output current	50 mA <sub>peak</sub>

### Power/dissipation factor, capacitance

Dissipation factor range	0...100
Accuracy for <sup>1</sup> :	
1 mHz < f < 100 Hz	1 % + 3 × 10 <sup>-4</sup>
f < 1 mHz and f > 100 Hz	2 % + 5 × 10 <sup>-4</sup>
Capacitance	10 pF ... 100 μF
Accuracy	0.5 % + 1 pF

### Time domain current measurement (PDC+)

Range	±10 mA
Accuracy	0.5 % + 1 pA

### Frequency Domain Spectroscopy (FDS)

Measurement voltage	200 V <sub>peak</sub>
Measurement current	±50 mA <sub>peak</sub>
Max. AC interference (50 Hz / 60 Hz) <sup>1</sup>	10 mA (SNR: 1:10)

### Frequency ranges

FDS frequency range	5 kHz ... 10 μHz
FDS & PDC+ frequency range	5 kHz ... 10 μHz
PDC+ frequency range	100 mHz ... 10 μHz

### Typical measuring time (FDS & PDC+)<sup>1</sup>

1 kHz ... 1 mHz	9 minutes
1 kHz ... 100 μHz	Between 15 min and 54 min
1 kHz ... 10 μHz	Between 30 min and 1 h 44 min

### Mechanical data / supply voltage

Dimensions (w × h × d):	
Device	260 × 50 × 265 mm/ 10.2 × 2 × 10.5 inch
Case	604 × 466 × 307 mm/ 24 × 18 × 12 inch
Weight:	
Device	2.3 kg / 5 lbs
Complete set	20 kg / 44 lbs
Supply voltage	85 V ... 265 V
Frequency	50 Hz ... 60 Hz

### Environmental conditions

Ambient temperature	
in operation	-10 °C ... +55 °C / +14 °F ... 131 °F
for storage	-35 °C ... +65 °C / -31 °F ... 149 °F
Relative humidity	5 % ... 95 %, non-condensing
Air-pressure (storage/operation)	70 kPa ... 106 kPa
Voltage withstand of output and measurement inputs	> 2kV (1.2 μs / 50 μs lightning impulse)

<sup>1</sup> For capacitances > 100 pF using default settings

## System requirements<sup>2</sup> for PTM

Operating system	<b>Windows 10™, 64-bit</b> <b>Windows 8™ and 8.1™, 64-bit</b> <b>Windows 7™ SP1, 32-bit and 64-bit</b>
CPU	<b>Multicore system with 2 GHz or faster</b> Single core system with 2 GHz or faster
RAM	minimum 4 GB ( <b>8 GB</b> )
Hard disk	minimum 5 GB of available space
Storage device	DVD-ROM drive
Graphics adapter	Super VGA (1280×768) or higher-resolution video adapter and monitor <sup>3</sup>
Interface	USB 2.0 <sup>4</sup> , Ethernet NIC <sup>5</sup>
Installed software <sup>6</sup>	<b>Microsoft Office® 2016</b> , Office® 2013, Office® 2010 or Office® 2007

<sup>2</sup> Recommended system requirements marked in bold

<sup>3</sup> Graphics adapter supporting Microsoft® DirectX 9.0 or later is recommended.

<sup>4</sup> USB 2.0 is needed for operation with FRANEO 800 and DIRANA.

<sup>5</sup> The Ethernet NIC is need for operation with CPC 100 and CIBANO 500.

<sup>6</sup> Installed software required for the optional Microsoft Office® interface functions.

## DIRANA packages

	Description	Order No.
DIRANA set	DIRANA comes in a rugged case which contains all necessary accessories such as 18 m long connection cables with clamps, drums etc. and the operating software Primary Test Manager™	P0005862



We create customer value through ...

## Quality

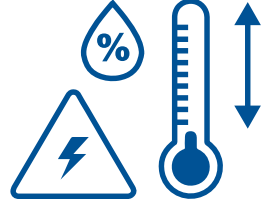
We always want you to be able to rely on our testing solutions. This is why our products have been developed with experience, passion and care and are continually setting ground-breaking standards in our industry sector.



You can rely on the highest safety and security standards

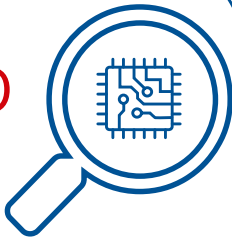
Superior reliability with up to

**72**



hours burn-in tests before delivery

**100%**



routine testing for all test set components

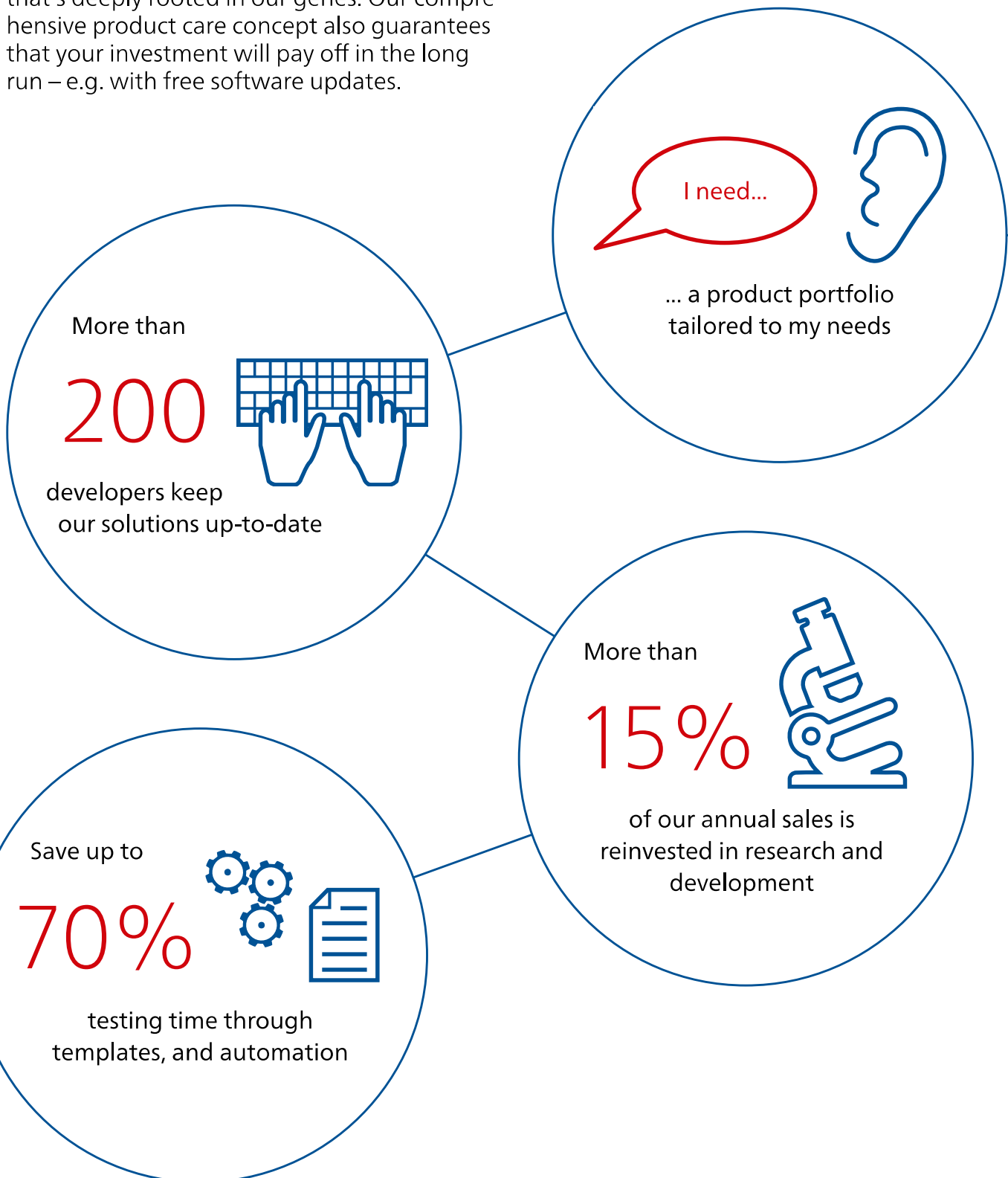
ISO 9001  
TÜV & EMAS  
ISO 14001  
OHSAS 18001



Compliance with international standards

## Innovation

Thinking and acting innovatively is something that's deeply rooted in our genes. Our comprehensive product care concept also guarantees that your investment will pay off in the long run – e.g. with free software updates.



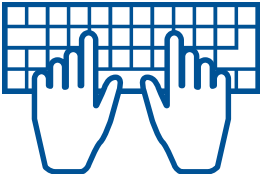
I need...



... a product portfolio tailored to my needs

More than

**200**



developers keep our solutions up-to-date

More than


**15%**



of our annual sales is reinvested in research and development

Save up to

**70%**



testing time through templates, and automation

We create customer value through ...

## Support

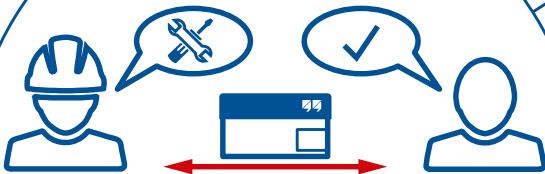
When rapid assistance is required, we're always right at your side. Our highly-qualified technicians are always reachable. Furthermore, we help you minimize downtimes by lending you testing equipment from one of our service centers.



Professional technical support  
at any time



Loaner devices help to  
reduce downtime



Cost-effective and straight-  
forward repair and calibration



offices worldwide for local  
contact and support



## Knowledge

We maintain a continuous dialogue with users and experts. Customers can benefit from our expertise with free access to application notes and professional articles. Additionally, the OMICRON Academy offers a wide spectrum of training courses and webinars.



Frequently OMICRON hosted user meetings, seminars and conferences

More than

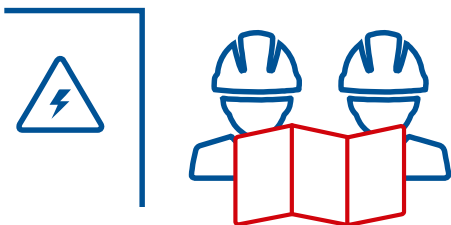
**300**



Academy and numerous hands-on trainings per year



to thousands of technical papers and application notes



Extensive expertise in consulting, testing and diagnostics

OMICRON is an international company that works passionately on ideas for making electric power systems safe and reliable. Our pioneering solutions are designed to meet our industry's current and future challenges. We always go the extra mile to empower our customers: we react to their needs, provide extraordinary local support, and share our expertise.

Within the OMICRON group, we research and develop innovative technologies for all fields in electric power systems. When it comes to electrical testing for medium- and high-voltage equipment, protection testing, digital substation testing solutions, and cybersecurity solutions, customers all over the world trust in the accuracy, speed, and quality of our user-friendly solutions.

Founded in 1984, OMICRON draws on their decades of profound expertise in the field of electric power engineering. A dedicated team of more than 900 employees provides solutions with 24/7 support at 25 locations worldwide and serves customers in more than 160 countries.

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

[www.omicronenergy.com](http://www.omicronenergy.com)

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