OMICRON

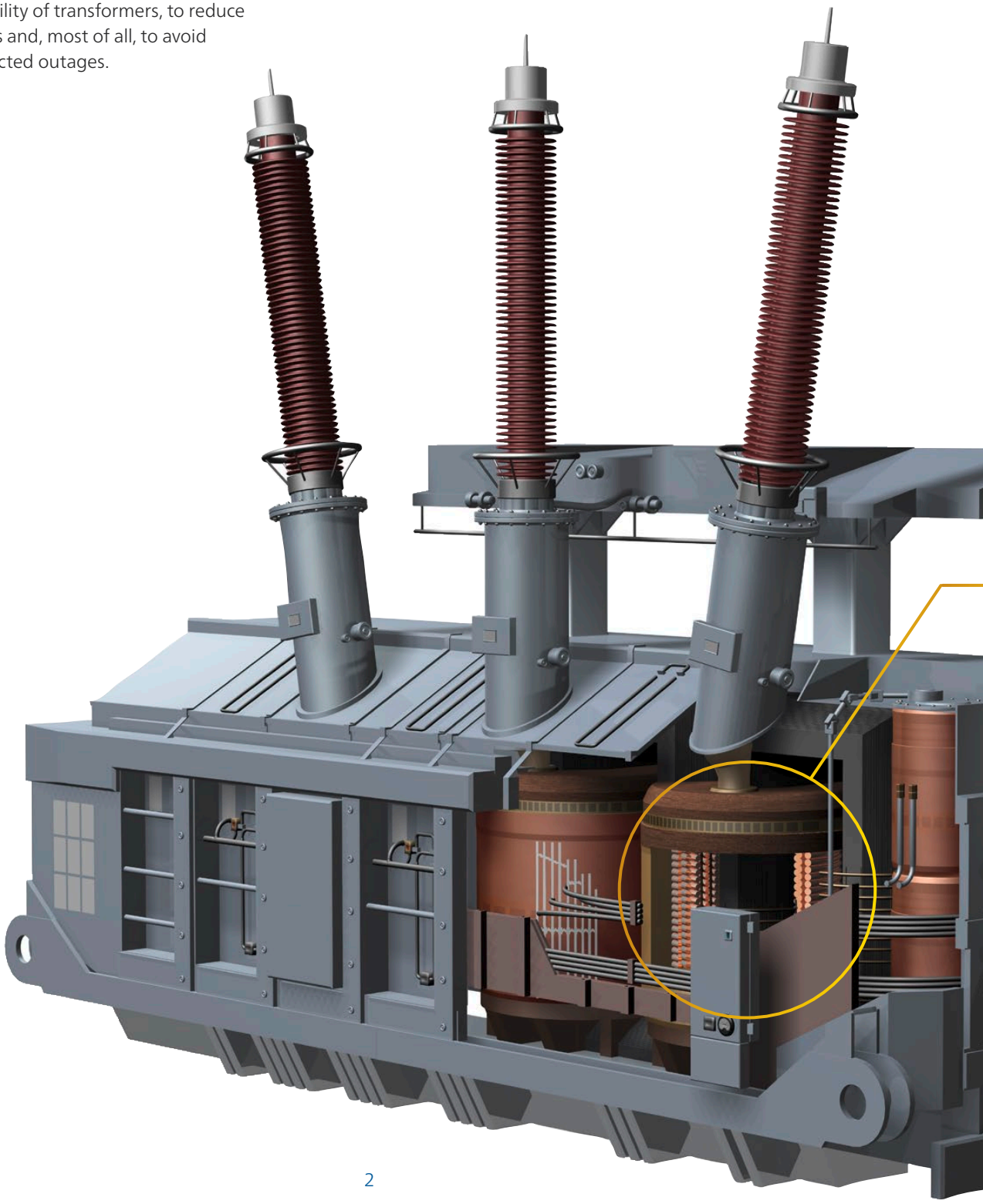
FRAnalyzer

Reliable core and winding diagnosis for power transformers

Power transformer core and winding diagnosis

Avoid additional costs by using diagnostics

The OMICRON FRAnalyzer detects mechanical and electrical changes of the core and winding assembly of power transformers. By finding winding or core defects after faults, mechanical shocks (e.g. earthquakes) or transportation, it offers a valuable opportunity to improve the reliability of transformers, to reduce maintenance costs and, most of all, to avoid expensive unexpected outages.



Deformed core

Collapsed tap winding

Damaged main winding

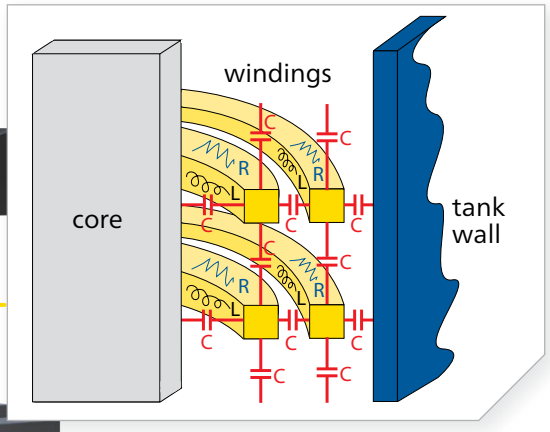
Displaced internal connections

Which problems can be detected?

FRAnalyzer can detect the following problems:

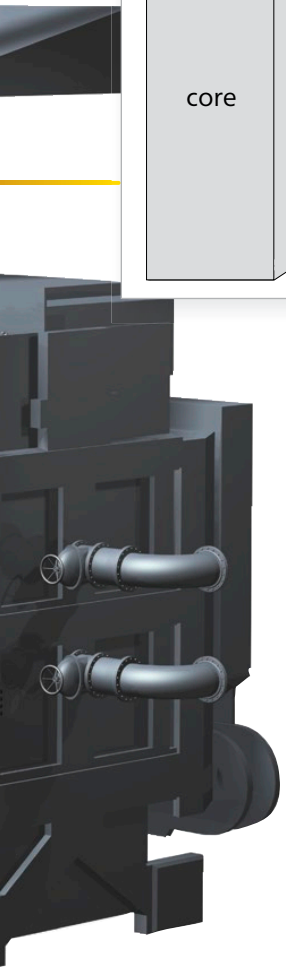
- >Winding deformation – axial & radial, like hoop buckling, tilting, spiraling
- Displacements between high- and low-voltage windings
- Partial winding collapse
- Shorted or open turns
- Faulty grounding of core or screens
- Core movement
- Broken clamping structures
- Problematic internal connections

How does it work?



Power transformers can be seen as a complex electrical network of capacitances, inductances and resistors. Each electrical network has got its unique frequency response. Therefore it is usually called a fingerprint. Geometrical changes within and between the elements of the network cause deviations of its frequency response.

Differences between such a fingerprint and the result of a later measurement are an indication of positional or electrical variations of the internal components. Different failures are directly related to different sections of the frequency range and can usually be discerned from each other.



Your benefits

- High reliability of transformers due to high-quality diagnostics
- Winding and core problems can be detected which remained hidden up to now
- Transformer integrity after faults, mechanical shocks or transportation can be assured
- Analysis helps avoiding unnecessary and expensive demounting of transformer's active part

Sweep Frequency Response Analysis (SFRA)

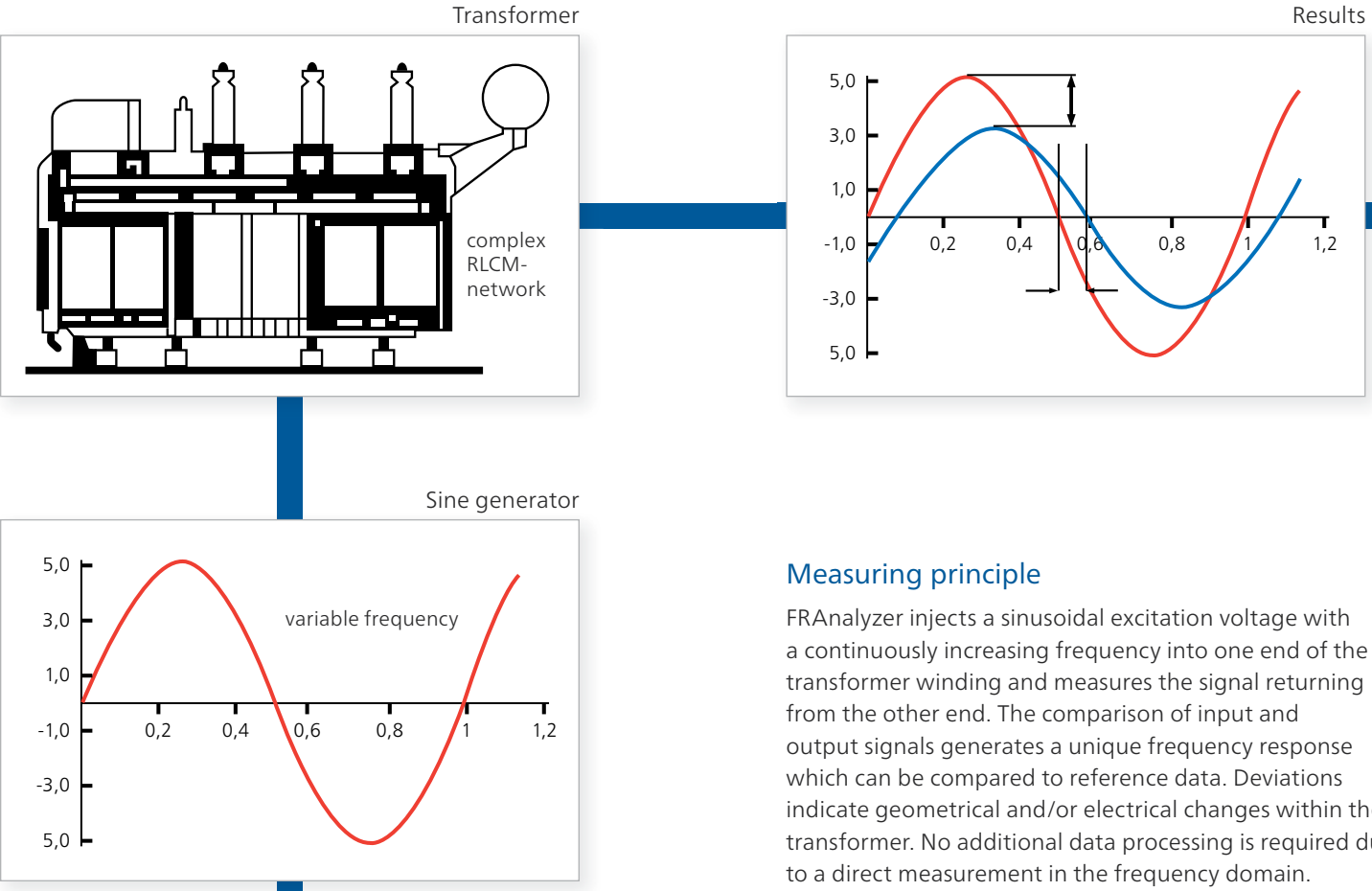
What is FRA?

Frequency Response Analysis (FRA) is a powerful and sensitive method to evaluate the mechanical integrity of core, windings and clamping structures within power transformers. It measures their electrical transfer functions over a wide frequency range.

FRAnalyzer uses the SFRA principle (Sweep Frequency Response Analysis) – a worldwide proven method for measurements in frequency domain. SFRA is a comparative method, i.e. an evaluation of the transformer condition is done by comparing an actual set of SFRA results to reference results.

When to use non-intrusive SFRA?

- After short-circuit testing
- Before and after transport
- After the occurrence of high transient fault currents
- Routine diagnostic measurement
- After significant changes of monitored values
- After the observation of unusual routine test results



Measuring principle

FRAnalyzer injects a sinusoidal excitation voltage with a continuously increasing frequency into one end of the transformer winding and measures the signal returning from the other end. The comparison of input and output signals generates a unique frequency response which can be compared to reference data. Deviations indicate geometrical and/or electrical changes within the transformer. No additional data processing is required due to a direct measurement in the frequency domain.

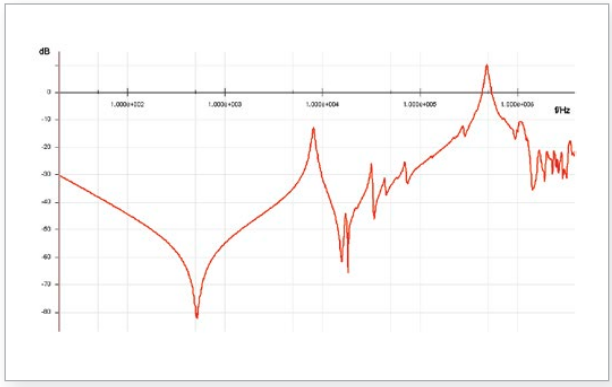
Commonly used assessment methods

Method	Used reference
time-based	earlier measurement of the same transformer
type-based	measurement of a type-equal transformer
phase comparison	measurement of other phases of the same transformer

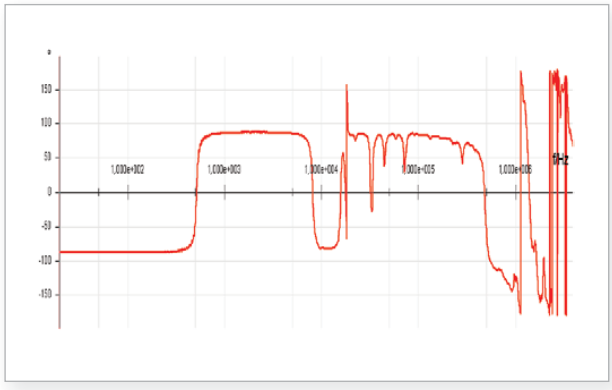
Why OMICRON's FRAnalyzer?

- SFRA principle is the industry standard for measurements in frequency domain
- Best reproducibility due to innovative connection technique
- Easy handling due to extremely small size and weight
- Highest convenience resulting from battery operation
- Easy-to-use software with implemented standard-based curve assessment solution

Amplitude



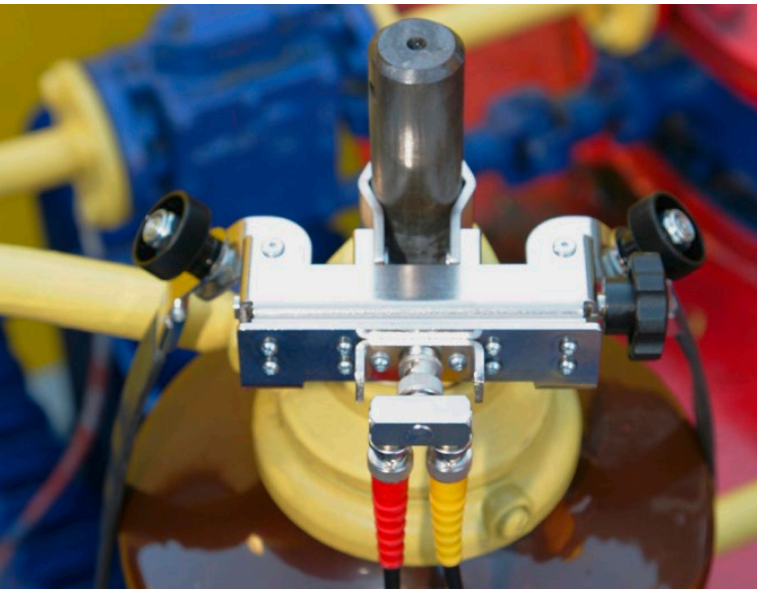
Phase



Your benefits

- SFRA is a non-intrusive test method, easy and fast to perform
- Core faults, shorted or open turns can be detected due to wide frequency range
- Small and light-weight equipment guarantee optimum usability

Unique connection technique



Exceptional reproducibility due to unique connection technique

Since SFRA is a comparative method, it is of vital importance that measurements reach a high degree of reproducibility. That is the only way to guarantee that deviations between actual and reference measurements are only related to defects within the observed transformer. Neither the external noise level nor inaccuracies within the measurement set-up must take any influence on the results.

According to the standard of knowledge, the connections between the measuring device and the transformer terminals, as well as the grounding technique, have a key influence on reproducibility.

Screw-type clamps for optimum connection

In close cooperation with leading universities in the field of FRA testing on power transformers, OMICRON has developed a sophisticated connection solution to achieve highest possible reproducibility of the results.

Specially designed screw-type-connection clamps provide reliable electrical contact to the transformer. The FRAnalyzer uses double shield coax cables to ensure the highest available signal-to-noise ratio.

Wide flat grounding braids for low-noise interference

To enable the grounding of the coaxial cable shields at the transformer housing, which is the reference potential, an additional connection from the terminal adapter to the transformer tank is required. A poor grounding technique can lead to unreproducible and therefore unusable SFRA results.

In order to achieve the best possible SFRA measurements, the grounding connections should be of lowest inductance and provide a large surface area. Therefore the use of braids, which are less sensitive to interferences and make the measurement independent from the cable positioning is strongly recommended.

Flexible length of grounding braids for optimum measuring set-up

The grounding braids should always run tightly along the body of the bushings in order to eliminate any influence of the grounding system on the measuring results. This is ensured by screw-type clamps which always connect the grounding braids with ideal length to the base of the bushing.

Only by using this exceptional set-up is it possible to comply with the strict demands of engineers around the globe requiring a “ground extension as short as possible and with the smallest achievable loop”.

Your benefits

- True-value results due to accurate reproducibility
- Screw-type clamps with spikes for reliable contacts even through layers of paint or dirt
- Minimal noise interference due to the use of broad grounding braids
- Optimum measuring set-up due to grounding braids with adjustable length

Easy and efficient software

Getting started easily

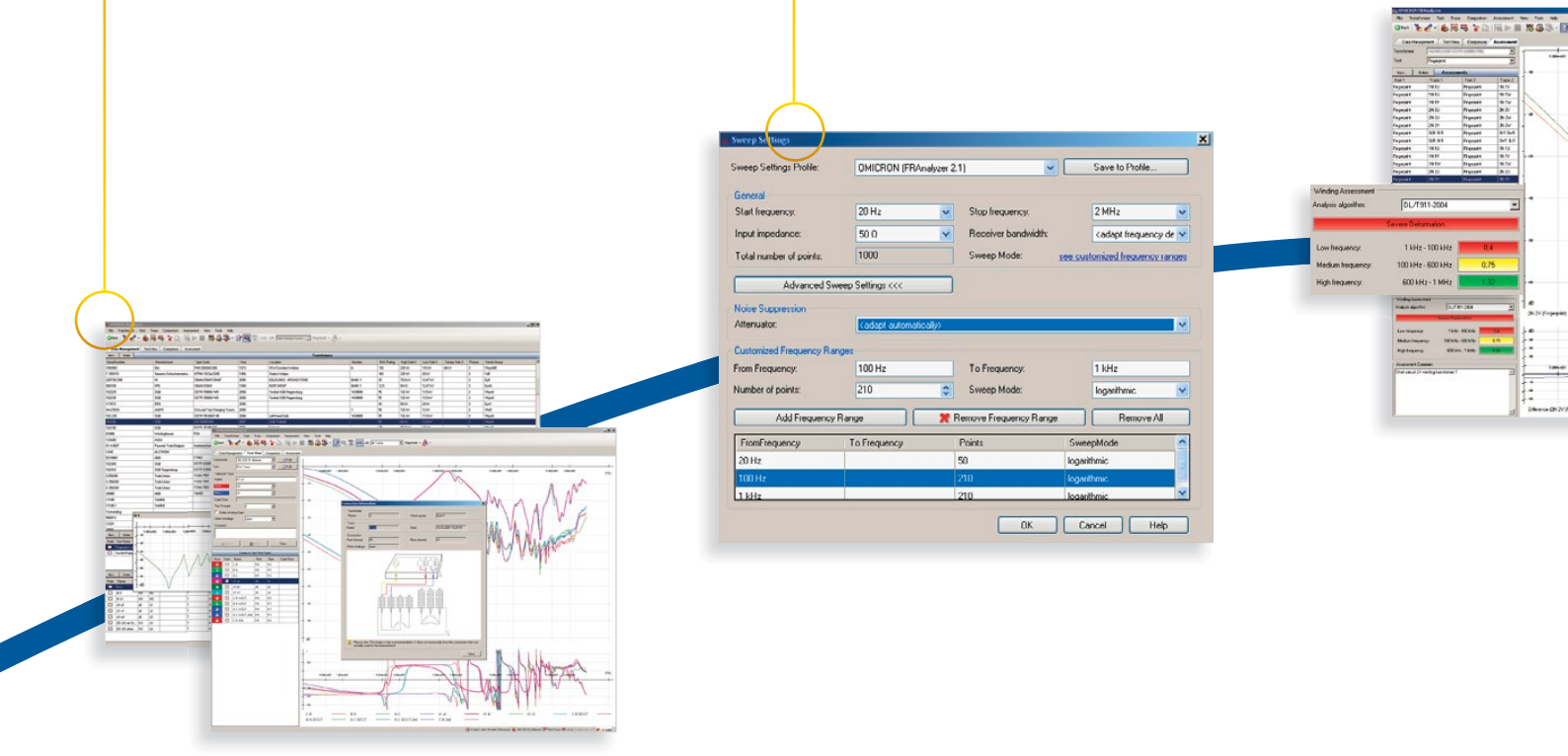
At the beginning of a test sequence the nameplate data of the transformer to be tested need to be entered. The terminal markings can be chosen from different templates such as IEC or ANSI and will be stored with all measured data. They can be used as template for later measurements.

Based on transformer type and vector group, a test sequence is suggested. Other sequences can also be added and changed freely and individually. The new connection scheme helps less experienced users with proper connection of the FRAnalyzer.

Flexible sweep settings for optimum measuring results

The sweep settings are fully customizable. They can be adjusted according to the number of measurement points and the receiver bandwidth in order to achieve an optimum signal-to-noise ratio.

In contrast to other measuring instruments with FRAnalyzer the measuring points can be set in linear or logarithmic scaling.



Easy assessment of measuring results according to standard

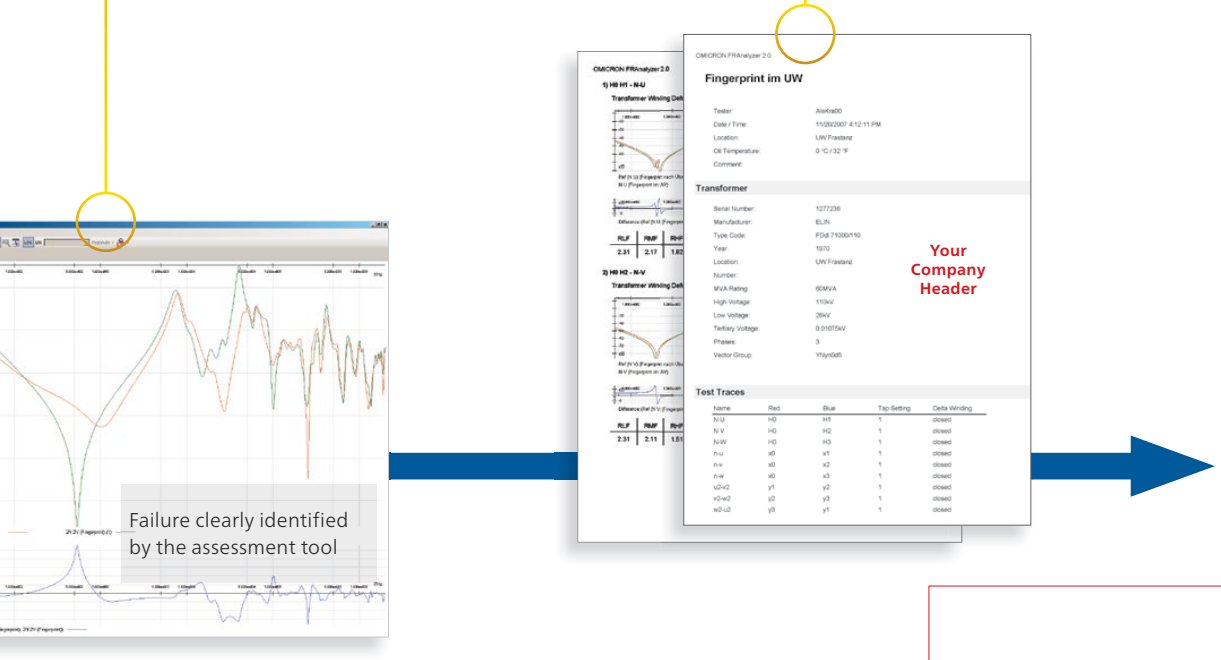
After the measurement a reference test can be defined. This can be a fingerprint of the same transformer or measured data of a type-equal transformer.

In addition to a manual comparison FRAnalyzer also provides the user a mathematical solution for a comparison of the traces based on the Chinese standard DL 911/2004.

Future-oriented documentation

All measured data is stored within the included database. Also existing measuring data in other data formats can be imported. The measurements can easily be sorted by transformer manufacturers, nominal power, location, or other criteria.

The FRAnalyzer software automatically generates a test report which is perfectly suited for own documentation. If necessary the data can also be exported in order to be processed in Microsoft Office®.



Your benefits

- Easy and supporting software tools for reliable measurements even for beginners
- High grade of flexibility due to freely selectable measuring settings
- Assessment of traces based on standards for easy analysis without expert knowledge
- Better overview and easy comparison of measurements via included database
- Effective documentation via automated test reports

Technical data and ordering information

Technical data

General

Frequency range	10 Hz ... 20 MHz (selectable)
Meas. point spacing	Logarithmic, linear, or both
Calibration interval	Every 3 years

Source output

FRA method	Sweep frequency
Output impedance	50 Ω
Connector	BNC (double shielded)
Amplitude	2.83 V_{pp} = 1 V_{RMS} at 50 Ω load
Number of meas. points	max. 3,201 (user-selectable)

Inputs (Reference – CH 1, Measurement – CH 2)

Impedance	Low (50 Ω) or high (1 MΩ) (selectable)
Connector	BNC (double shielded)
Dynamic range	> 120 dB
Accuracy	
Typical accuracy	< 0.1 dB (down to -50 dB) and ±1 dB (between -50 dB and -80 dB)
Guaranteed accuracy	±0.3 dB (down to -50 dB) and ±1.2 dB (between -50dB and -80dB

Environmental

Operating ambient temperature	-10°C ... +55 °C / +14 °F ... +131 °F
Operating relative humidity	20 % ... 95 %, non-condensing

Mechanical data / supply voltage

Weight	< 2 kg
Dimensions (W × H × D)	26 × 5 × 26,5 cm / 10.25 x 2 x 10.5 in
DC power supply	DC 10 V ... 24 V / 10 W
AC power supply	AC 100 V ... 240 V / 50 Hz ... 60 Hz

PC requirements (minimum)

Interface	USB 1.1
PC operating system	Windows XP™ [1], Windows Vista™ 32bit or Windows 7™ 32bit/64bit
Processor	Pentium™ 1 GHz
Memory	1 GB RAM
Drive	CD-ROM

[1] As Microsoft® stopped technical assistance for Windows XP™ after April 8, 2014, Windows XP™ will no longer be supported by any release after December 31st, 2014.

Ordering information

FRAnalyzer package
(Order no. VE000660)

1 ×	Coaxial-cable red with cable drum (18 m / 59 ft)	VEHK0660
1 ×	Coaxial-cable blue with cable drum (18 m / 59 ft)	VEHK0661
1 ×	Coaxial-cable yellow with cable drum (18 m / 59 ft)	VEHK0662
4 ×	Aluminum braid rolls (5 m / 16 ft)	VEHZ0661
1 ×	Grounding cable 6 mm² gn/ye (6 m / 20 ft)	VEHK0615
4 ×	Screw-clamps for aluminum braid	VEHZ0662
2 ×	Bushing-clamps	VEHZ0664
1 ×	BNC adapter set	VEHZ0667
1 ×	User manual	VESD0662
1 ×	Power supply and battery charger	VEHZ0659
1 ×	Crank handle	VEHZ0657
1 ×	FRAnalyzer Software	

Additional accessories for FRAnalyzer

Clamps set for short bushings (consisting of 2 short aluminum braids (1.5 m / 5 ft), 2 clamps and 1 carry bag)	VEHZ0673
FRAnalyzer software upgrade to 2.0 (for users of older software versions than 2.0)	VESM0661

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.

www.omicron.at | www.omicronusa.com