FRA 5310

Sweep Frequency Response Analyser for Power Transformer Diagnosis

The **FRA 5310** Sweep Frequency Response Analyser detects transformer winding movements and mechanical failures due to mechanical shock, transportation or short circuits.

APPLICATIONS

Many dielectric and mechanical failures in large power transformers are preceded by mechanical changes in the winding structure. These changes, or displacements in the winding, may be the result of:

- Transportation damage occurring between the manufacturer and the final location
- Short circuit forces imposed on the windings resulting from a low impedance fault occurring close to the transformer
- Natural effects of aging on the insulating structures used to support the windings

Detection of these displacements ahead of a dielectric failure can reduce unplanned maintenance costs, and provide the possibility to improve system reliability by preventing outages. Additionally, when damage is discovered, repairs may be targeted to a specific phase winding.



METHOD

The corresponding HF circuit of a transformer winding is a complex R-L-C-network. The measured frequency response (transfer function) of this network is unique like a fingerprint.

Changes in the winding geometry will be reflected by deviations between repeated measurements. Even small winding movements or distortions will cause legible changes in the measured transfer function, which is clearly detectable.

Deviations can be caused by short-circuited turns, open windings, mechanical damage to windings or core, loose turns, faulty clamps, etc.

DESIGN

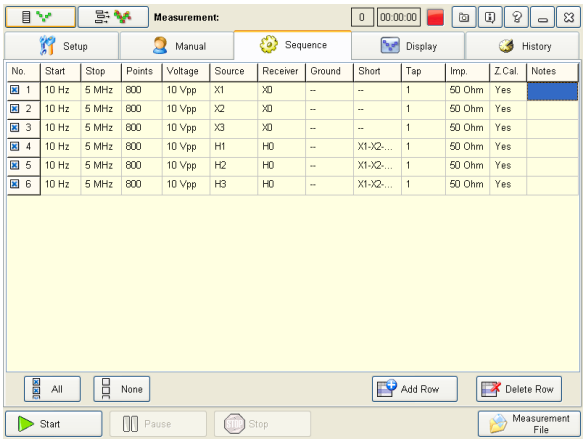
The FRA 5310 software and the large touch-screen interface guarantee a very easy-to-use instrument. Load measurements, set configurations, obtain connecting information, repeat previous measurements and do comparisons just on a fingertip. Integrated analysis tools, reporting capability and additional PC software complete this advanced Sweep Frequency Response Analyser.

FEATURES AND BENEFITS

- ☑ **High measurement reliability and reproducibility** due to active probes design and a clear defined connection and grounding technique
- ☑ **High signal-to-noise ratio** due to output voltage up to 12 Vpeak-peak at 50 Ω (24 Vpeak-peak at 1 MΩ)
- ☑ **Automatic Interpretation** according to Chinese Standard DL / T 911 - 2004
- ☑ **Ease of use** due to automated Windows test software and large color touch screen interface and remote start button
- ☑ **IEC60076-18 Appendix E** XML file format compatible, to **share test results with other devices**
- ☑ **Rugged, lightweight and small** all-in-one field design
- ☑ **Measuring modes** (amplitude & phase):
  - Transfer Voltage Function U1/U2 (f)
  - Impedance Function U1/I2 (f)

Previously stored curves are accessed using the History tab sheet, where information can be edited and updated at a later date.

Automatic Test Setting (Sequence)

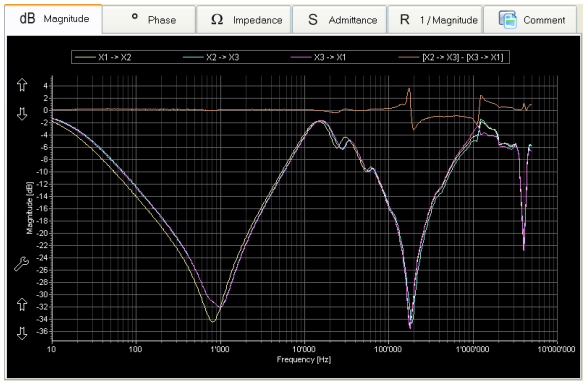


Analysis page with limits set according to the standards

A complete transformer test measurement list (sequence) can be predefined and executed automatically when required, making it simple to repeat a previous fingerprint measurement, even if the operator has no previous knowledge of the setup.

The analysis system allows multiple stored measurements to be loaded for detailed analysis, comparison, verification, reporting, etc.
The measured transfer function curves can be displayed as **Magnitude [dB], Phase [°], Impedance [Ω] , Admittance [S] and Ratio.**
Additional comments can be stored with the single analysis displays so expert interpretation and assessments, further test instructions, etc can be included.

Various **display tools** are easily accessible from the touch screen to allow simple analysis: Zoom-in and -out, auto scaling, linear and logarithmic scaling, curve shifting, measuring point labels, save as meta-file, printout, title editing, setup information editing, frequency band display, etc.

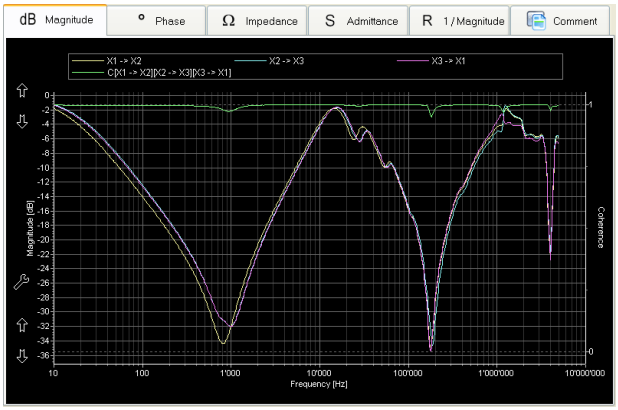


Two frequency response curves and their difference.

Cursors can easily be placed anywhere on the displayed curves giving the user information down to the last measuring point.

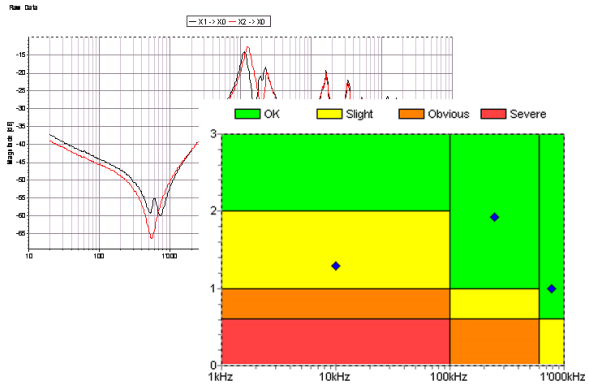
Differences of curves with a definable limiter function can be calculated allowing parts of the curve to be weighted and highlighted to help the engineer's decision-making.

Coherence between two or more curves can be calculated to give the engineer a powerful tool for the assessment and comparison of transformer transfer curves yielding valuable additional information.



Transfer functions of 3 phases and their coherence.

Interpretation according to Chinese Standard DL / T 911 - 2004 is supported. This interpretation is based on the comparison of two curve, identifies slight, obvious and severe mechanical changes and differentiate between typical origins of the damage.



Comparison of two transfer functions according to Chinese Standard DL / T 911- 2004.

REPORT GENERATION

The measured frequency response curves (raw data) are stored in a measuring data file together with all the related transformer nameplate data and other additional information.
Reports can be created from the measured data file (raw data curves) or from any analysis data files previously created.

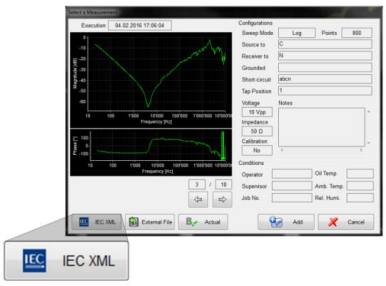
The user can choose different report sizes from diagrams with short setup info to full reporting with all detailed setup and DUT information.
Reports are automatically generated in XML- or HTML- format allowing the report file to be opened in a web browser or word processor.

Data export

The measuring files (raw data curves) are stored in XML format and can also be stored in CSV (comma-separated-values) format.

They can be directly opened in Microsoft EXCEL or other spreadsheet programs where further customer specific data processing, calculation, comparison and documentation is possible.
Any curve can also be stored as a picture for further use in customer specific documentation or reporting.

IEC 60076-18 File Data Format



following the IEC60076-18 recommendation the FRA5310 includes the file format specified in the appendix e.

With this feature, loading test results done with other manufacturer's measuring devices is now possible, as long as the manufacturer of that device has fulfilled the requirements of the IEC60076-18 -appendix E file format. In addition, a test done with the Tettex FRA 5310 could also be loaded by any other device capable of reading this file format.



SCOPE OF SUPPLY

Type 5310 Instrument in rugged shell case, Cable back pack including:

- 2 Active Probes with 15 m double shielded cables,
- 2 Ground Tapes 10 m,
- 2 Ground Tape Clamps,
- User Manual, Test Certificate,
- Mains cable CD with external PC Analysis Software

TECHNICAL SPECIFICATIONS

Measurement	
Type	Active probes
Frequency Range	10 Hz .. 10 MHz, user defined
Voltage Output	max. 12 Vpeak-peak at 50 Ω, max. 24 Vpeak-peak at 1 MΩ, user defined
Input Impedance	selectable 50 Ω or 1 MΩ
Output Impedance	50 Ω
Feasible accuracy(1)	± 0.1 dB , from +10db to -40db ± 1 dB , from –40db to -90db
Dynamic range	>100 dB
Measuring Points	max. 2'000, user defined, logarithmically spaced,
Protection	Against short circuit, overload

Data Display	
Scaling	Logarithmic or Linear, user defined
Frequency Range	10 Hz .. 10 MHz, user defined
Plot, Frequency vs.	Magnitude, Impedance, Phase, Admittance, Ratio

Controller	
Processor	Intel Atom
RAM	2 Gb
Interfaces	USB 2.0 , RS232
Data Storage	Compact Flash
Display	10.4", SVGA, Color TFT
User Interface	built-in Touch Screen

General	
Operating Temperature	0 .. +50°C
Storage Temperature	-20 .. +70°C
Relative Humidity	10 .. 90 % non-condensing
Weight Instrument	8 kg (17 lbs)
Dimensions Instrument	41 x 31 x 17 cm (16" x 12.2" x 7")
Remote Start	Remote start button and indicator in probe
Mains	Universal, 90 .. 265 VAC, 50 / 60 Hz, 75 VA
Instrument OS	Windows 7 Embedded
External PC Software	Windows XP/ Vista / 7

Order code	FRA 5310 No. 3490047

(1) Between 20HZ and 2 MHz

COMPLETE PORTFOLIO FOR TRANSFORMER TESTING

■ TTR 2796

Transformer Turns Ratio Meter with 250 V test voltage



Onsite testing of turns and voltage ratio, phase displacement and excitation current. Automatic winding connection identification and vector group detection. Remotely controllable via USB.

■ 2293

Automatic Transformer Winding Analyser



It uniquely combines winding resistance measurement, turns ratio, dynamic resistance measurement, core demagnetisation, transformer type detection, magnetic balance, short circuit impedance and heat run test (temperature rise and cooling curve) in the fastest single instrument solution on the market.

■ 5462

Recovery Voltage Meter



Mobile system for non-destructive diagnosis of the state of paper-oil insulation (effect of moisture content and aging) using the recovery voltage method.

■ MIDAS MICRO 2883

Mobile Insulation Diagnosis & Analysing System



The MIDAS micro 2883 is the smallest and most compact insulation diagnosis set on the market. The weight of only 25 kg / 55 lbs and the one box design makes it the ideal tool for power / dissipation factor / tan δ and

■ OC60E

Oil Cell Tester



Fully automated digital liquid electrical test set designed to reliably and accurately test the dielectric strength of insulation liquids.

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HAEFELY HIPOTRONICS has a policy of continuous product improvement. Therefore we reserve the right to change design and specification without notice.

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