

# Sweep Frequency Response Analyzer **FRA500**

- Sweep frequency range: 0,1 Hz – 25 MHz (selectable)
- Dynamic range: >150 dB
- Computer interface: USB and Bluetooth
- Battery backup (optional): 12 V, 7 Ah for 4 hours of operation
- Typical sweep time less than 20 seconds (20 Hz – 2 MHz)
- Superior frequency response in noisy environment
- Sample points per sweep: 1 046 points by default, 32 000 points total
- Correlation calculation per the C57.149-2012 and DL/T 911-2004 standards
- Enabled test result comparison due to possibility of importing data from other manufacturers
- PC based analysis software with user friendly interface with pre-defined test plans and reporting feature for greater efficiency and productivity

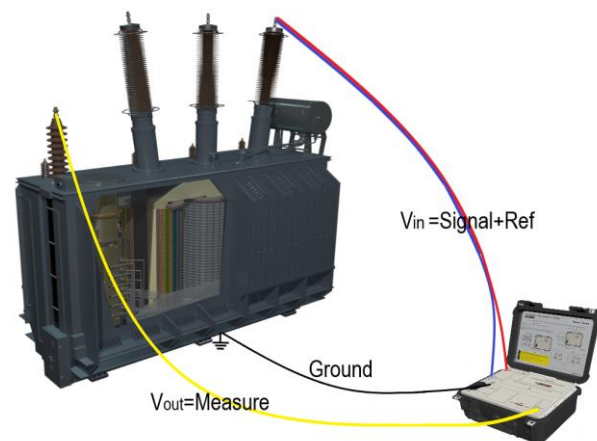


## Description

FRA500 can confirm the mechanical integrity of the transformer by comparing the frequency response of the transformer with the previously known results.

Every transformer has a unique frequency response system which changes if the mechanical geometry of the transformer is changed. These changes can occur due to physical movement or transportation. The physical geometry can also change if the transformer experiences high fault current due to internal or external fault. The fingerprint comparison of the frequency response system can be used to detect power transformer problems such as:

- Core movements
- Shorted turns or open windings
- Winding displacements or deformations
- Winding connection problems
- Broken clamping structures
- Faulty core grounds
- Core connection problems



*FRA500 Benefits and features*

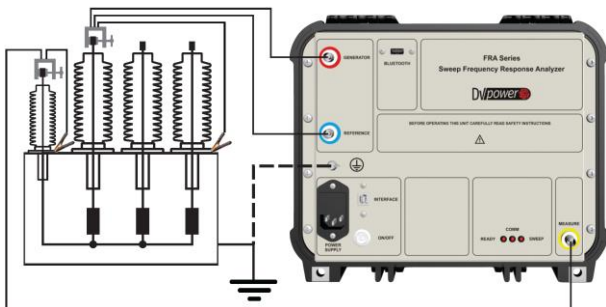
FRA500 injects a sine wave signal with constant amplitude and variable frequency to one side of a transformer winding. The amplitude and phase angle values of the reference (output) signal are then compared with the corresponding values of the measured signal (from the second side of the winding). The ratio of the measured signal and reference signal magnitude is graphically displayed in dB through the full sweep frequency. The phase difference value between the measured and reference signals is also displayed through the full sweep frequency.

## Connecting FRA500 to Test Object

FRA500 is provided with three coaxial signal cables with ground straps, two signal clamps, and two ground clamps.

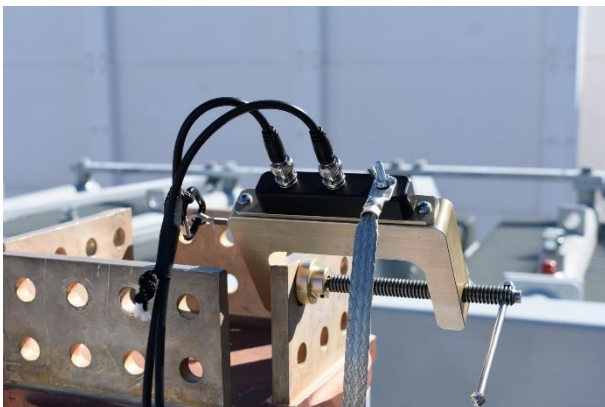


- Always connect the safety ground cable to the FRA500 unit first.
- The transformer under test must be cleared and isolated.
- The transformer bushing must be isolated and free from any corrosion or oxidation.



Connecting FRA500 to transformer (IEC 60076-18)

To make a frequency response measurement, a low voltage signal is applied to one terminal of the test object with respect to the tank.



"Generator" and "Reference" leads connection to the large signal clamp

The voltage measured at this input terminal is used as the reference signal and a second voltage signal (the response signal) is measured at a second terminal with reference to the tank.



"Measure" lead connection to the large signal clamp

Poor connections can cause significant measurement errors, attention shall be paid to the continuity of the main and earth connections. The continuity of the main and earth connections shall be checked at the instrument end of the coaxial cable before the measurement is made.



Earth connection to the ground clamp

Earth connections from the "Generator" and "Reference" leads to the tank may be combined in a single conductor. The earth connection point shall be as close as practicable to the base of the bushing or terminal to which the measurement lead is connected.

## Benefits and Features

### Sweep Frequency Range and Sweep Time

The FRA500's sweep range is user-selectable from 0,1 Hz - 25 MHz. A typical test sweep time, with frequency ranging from 20 Hz to 2 MHz is less than 20 seconds. A quick sweep test can be performed in under 10 seconds to confirm proper cable connections.

### Output Voltages

The FRA500's test voltage range is programmable from 0,2 V p-p to 24 V p-p in 0,2 V p-p steps. This enables the user to match the test voltage to tests performed by another manufacturer's device.

### Dynamic Ranges

The FRA500 offers a dynamic range greater than 150 dB with a measurement accuracy of  $\pm 0,5$  dB. The higher dynamic range eliminates the effects of noise and facilitates the comparison of different sweeps.

### Computer Interfaces

The FRA500 is computer-controlled via USB or wirelessly via Bluetooth. The Bluetooth feature allows test personnel to be at a comfortable distance from the transformer for increased safety and productivity.

### Optional Battery Backup

An optional built-in battery backup is also available that can provide power for up to four hours. The FRA500 uses a sealed lead acid battery (12 V, 7 AH).

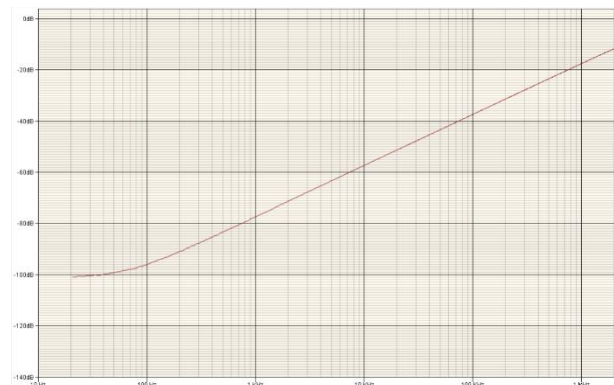
### Self-check test

As included accessories, there is always verification box intended for the self-check of the unit (see picture below).



FRA500 - verification box connection

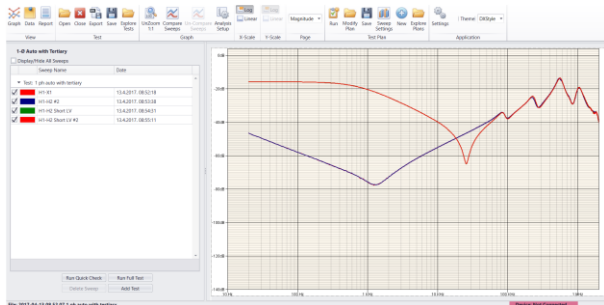
After the full test has been executed and if everything is fine with the unit, the following trace will be displayed:



FRA500 Self check test (good condition)

## DV-FRA Software

Windows-based sweep frequency response analysis software is included with each FRA500. The software can perform tests automatically and can be used to analyze the test data.



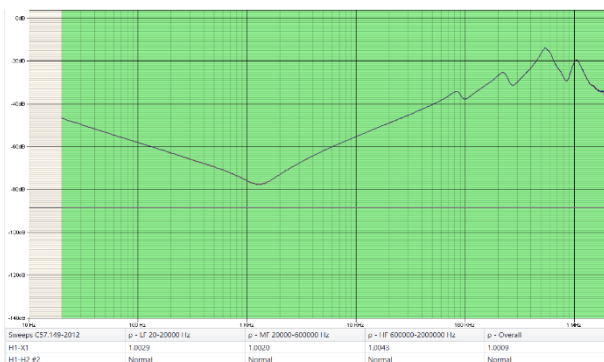
DV-FRA - software

Users can quickly run tests in the field using pre-defined test connections. These include user-defined configurations as well as configurations defined by the **IEEE C57.149-2012** standard. Test data can be exported to XML and EXCEL formats.

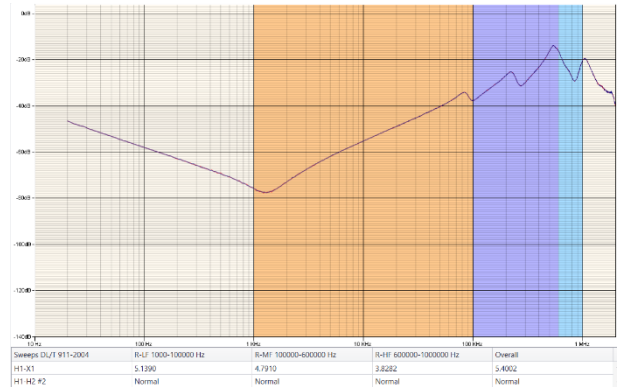
The FRA500 software can import SFRA test records allowing the user to compare the FRA500 test records against other devices on the market.

### Test results interpretation feature

The software graphically compares test results as a magnitude vs. frequency plot, phase vs. frequency graph, or display both graphs at the same time. The software provides an analytical tool that can perform correlation coefficients between two traces per the **IEEE C57.149-2012** or **DL/T 911-2004** standard.



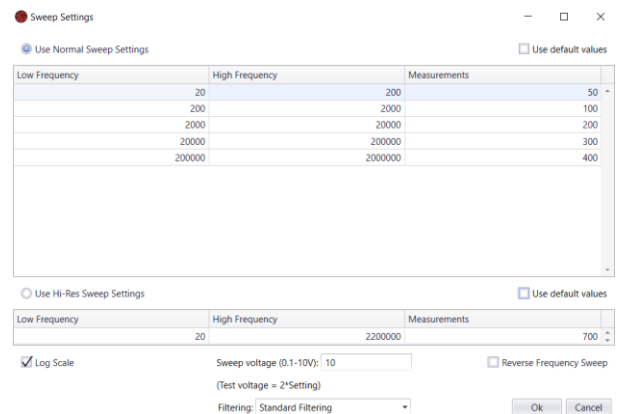
IEEE C57.149-2012 - Graphical comparison of two different traces



DL/T 911-2004 - Graphical comparison of two different traces

## Configuring the Sweep Settings

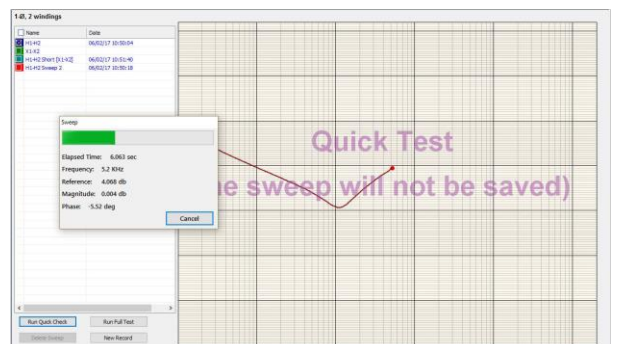
Sweep voltage and the number of measurements can be defined for a given frequency range. Two pre-defined sweep configurations are available, "Normal" and "High-Res". The default parameters for each configuration are listed in the table below each configuration.



Sweep settings configuration

## Quick Check Test

Once the all necessary cables are connected, a quick check test can be executed to make sure the connections are working or to get an idea of what the full resolution sweep graph will look like:



Quick check test



## Technical Data

### Mains Power Supply

- Connection: according to IEC/EN60320-1; UL498, CSA 22.2
- Mains supply: 90 – 264 V AC, 47 - 63 Hz
- Input power: 50 VA
- Fuse: T5L250V

### Measurement

- Sweep frequency range: 0,1 Hz – 25 MHz
- Sampling rate: 100 mega samples per second
- Sample points per sweep: 1 046 points by default, 32 000 points total (user selectable)
- Total sweep time: less than 20 seconds (20 Hz – 2 MHz)
- Point spacing: log, linear, or both
- Accuracy:  $\pm 0,1$  dB from +10 to -40 dB and  $\pm 0,5$  dB below -40 dB
- Input channels: 2 x 50  $\Omega$  impedance
- Sampling: Simultaneous
- Output channels: 1 x 50  $\Omega$  impedance, short-circuit and overvoltage protection
- Compliance voltage: 0,2 – 24 V p-p in 0,2 V p-p steps
- Measurement voltage at 50  $\Omega$ : 0,1 – 12 V p-p
- Frequency resolution: 0,01 %
- Frequency accuracy: 0,01 % (measurement error)
- Level resolution: 0,0005 dB

### Environmental Conditions

- Operating temperature: -20 °C – +55 °C / -4 °F – +131 °F
- Storage temperature: -20 °C – +70 °C / -4 °F – +158 °F
- Humidity: <95% RH, non-condensing

### Dimensions and Weight

- Dimensions (W x H x D): 340 x 290 x 150 mm / 13 x 11 x 6 in
- Weight: 4,5 kg / 10.0 lbs.

### Warranty

- 3 years

### Battery (optional)

- SLA 12 V, 7 Ah for 4 hours of continuous operation

### Applicable Standards

- Safety: LVD 2014/35/EU (CE Conform), Standards EN 61010-1:2010
- EMC: Directive 2014/30/EU (CE Conform), Standard EN 61326-1:2013

### Interface

- Bluetooth
- USB

*All specifications herein are valid at ambient temperature of + 25 °C and recommended accessories. Specifications are subject to change without notice.*

## Accessories



Large Signal C Clamps



Coaxial Signal Cable - Measure



Ground Cables with Clip



Ground C Clamps



Coaxial Signal Cables - Generator/Reference



Verification Box



Power and Ground Cables



Flat Ground Cable

## Ordering Info

Instrument	Article No
Transformer Frequency Response Analyzer FRA500	FRA500X-N-01
Transformer Frequency Response Analyzer FRA500 (battery operated)	FRA500X-B-01
Included accessories	Article No
Windows-based DV-FRA PC software including USB cable	
Mains power cable	
Ground (PE) cable	
Transport case	
Recommended accessories	Article No
Verification box with three coaxial cables	VERBOX-3C-00
Coaxial signal cable (yellow) 10 m	COAX-10XX-Y0
Coaxial signal cable (red) 10 m	COAX-10XX-R0
Coaxial signal cable (blue) 10 m	COAX-10XX-B0
Large signal C clamp x2	LSC-CLMP-000
Small ground C clamp x2	SGC-CLMP-000
Flat ground cable x2	CABLE-GND-F0
Ground cable with clip x2	CABLE-GND-C0
Optional accessories	Article No
Coaxial signal cable (yellow) 15 m	COAX-15XX-Y0
Coaxial signal cable (red) 15 m	COAX-15XX-R0
Coaxial signal cable (blue) 15 m	COAX-15XX-B0
Coaxial cable (yellow) for Verification box	CXVB-0Z3-Y00
Coaxial cable (red) for Verification box	CXVB-0Z3-R00
Coaxial cable (blue) for Verification box	CXVB-0Z3-B00
Coaxial cables for Verification box - set	CXVB-0Z3-000
Hard transport case	HARD-CASE-F1