

# M5400



## M5400 SWEEP FREQUENCY RESPONSE ANALYZER (SFRA)

TOGETHER WE POWER THE WORLD®

### A tool for detecting “hidden” transformer faults

The M5400 detects mechanical failure or movement of windings due to short circuits, mechanical stresses or transportation. Use it to ensure transformer performance, reduce maintenance cost, and increase the service life of transformers.

### A major advance in transformer condition analysis.

The M5400 uses Sweep Frequency Response Analysis, a proven technique for making accurate and repeatable measurements. Pioneered by Doble the sweep approach has become the industry standard and is the preferred method for making frequency domain measurements.

Here's how SFRA works: The M5400 sends an excitation signal into the transformer and measures the returning signals across a broad frequency range. By comparing this response to baseline and other results (such as from similar units), you can identify deviations and confirm internal mechanical problems.

**DIAGNOSE** problems early.

**PREVENT** expensive equipment failures.

Take **CONTROL**.

Why wait for problems to develop? With the M5400's non-intrusive test technique, you can test your power apparatus any time you suspect a problem. Or just use it as part of your regular maintenance program. Either way, you identify problems before they lead to failure, such as:

- Core movement
- Winding deformation and displacement
- Faulty core grounds
- Partial winding collapse
- Hoop buckling
- Broken or loosened clamping structures
- Shorted turns and open windings



### M5400

Sweep Frequency Response Analyzer (SFRA) For Transformer Core & Winding Movement Diagnosis.

# M5400 SFRA

## Technical Specifications

### Excitation Source:

Channels:	1
Frequency Range:	10 Hz – 25 MHz
Output Voltage:	20 V peak-to-peak at 50 Ohms
Output Protection:	Short circuit protected
Source Impedance:	50 Ohms
Calibration Interval:	3 years

### Measurement Channels:

Channels:	2
Sampling:	Simultaneous
Frequency Range:	10 Hz – 25 MHz
Max. Sampling rate:	100 MS/s
Input Impedance:	50 Ohms
Calibration Interval:	3 years

### Data Collection:

Test Method:	Sweep Frequency
PC Comm:	Ethernet USB/Serial
Frequency Range:	10 Hz – 25 MHz
Number of Points:	1000 points (Default) Up to 1800 points (Extended Range)
Point Spacing:	1.2 % Logarithmic
Dynamic Range:	>90 dB
Repeatability:	±1 dB to –80 dB
IF Bandwidth:	< 10% of active frequency

### Data Display:

Scaling:	Linear/Log
Frequency Range:	10 Hz – 25 MHz, user defined within frequency range
Plotting:	Frequency vs. Magnitude / Phase
Analysis:	Difference, Sub-band Cross-Correlation

### Physical Specifications:

Dimensions:	18.2 x 13.4 x 6.7 inch 46.2 x 34.0 x 17.0 cm
Weight:	13.1 lbs (6.0 kg)
Power Supply:	100-240V AC
Temperature:	0° to 50° C operating, -25° to + 70° C storage
Relative Humidity:	0% to 95 % non condensing

### Test Leads Construction:

Integrated three lead system in single cable set  
Standard (362 kV and below): 60 ft/ 18 m  
Optional (> 362 kV): 100 ft/ 30 m

### PC Requirements:

With minimum configurations as:  
Ethernet/USB Windows 2000 or Windows XP  
Intel Celeron 1.3 GHz  
Minimum 512 MB RAM or more  
Minimum 40 GB DVD-RW

*Specifications are subject to change without notice.*

## M5400 Technical Merits

### Range

The M5400 provides a frequency response measurement from 10 Hz to 25 MHz. Doble recommends the default setting of 20 Hz - 2 MHz for transformers as there is limited diagnostic value in measurements outside of this range. The diagnostic frequency range of 20 Hz to 2 MHz covers the most important diagnostic areas:

- Core and Magnetic Properties
- Winding Movement and Deformation
- Interconnections – Leads and Tap Changers

### Resolution

The M5400 measures the frequency response at logarithmically spaced frequency intervals of 1.2%. A constant excitation level is maintained for each frequency measurement. The M5400 has the ability to auto-scale each frequency measurement providing an overall dynamic range of 80 dB with a ±1 dB accuracy. This gives the highest combination of dynamic range and accuracy available.

### Repeatability

The M5400 is a field-ready instrument for high quality measurements. The sweep frequency approach combined with Doble's world class engineering means that frequency response measurements are highly repeatable and even subtle changes can be used for diagnostic purposes.

### Test Leads

We provide simple, robust test leads to handle the rigors of site testing. International tests have proven repeatedly that we have the most reliable and repeatable test leads available.

### Practicality

The M5400 is supported by Doble's world class Client Service Engineers and decades of field experience. We have learned through practice and experimentation what constitutes good field technique and know how to gain value and benefit from the SFRA measurement. Let us work with you to bring that value and benefit to your company!

*For more information, email [sfra.info@doble.com](mailto:sfra.info@doble.com)*



### Doble Engineering Company

85 Walnut Street  
Watertown, MA 02472 USA  
tel +1 617 926 4900  
fax +1 617 926 0528