

# The Woofer Tester 2

## Precision Thiele-Small & RLC Measurement Simulation and Box Analysis



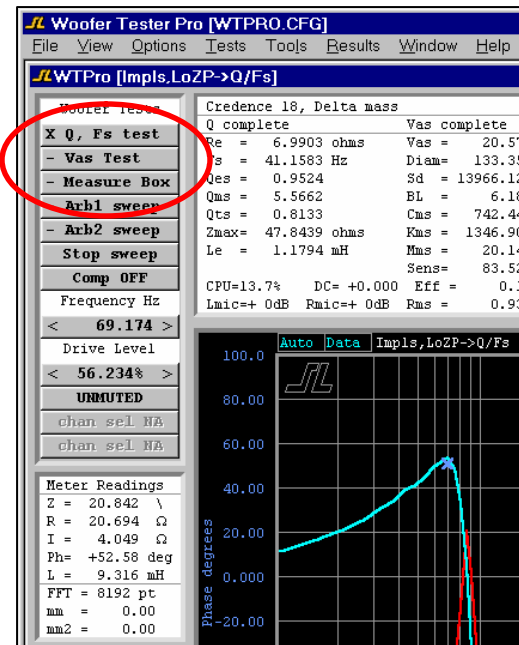
# Features

- Precision Thiele Small Measurement System using Constant Current Source
- Advanced Thiele Small Simulator with Frequency Dependent Le
- Alignment Analysis of Sealed, Vented, Passive Radiator & Band Pass Boxes
- Sophisticated Auto-Alignment Incorporates Driver Parameter Shifts
- Direct Measurement of Amplitude & Phase using DSP Filtering (not FFT interpolation)
  - For Best Possible Measurement and Modeling Results
  - .001 Hz resolution from 1-20 kHz (measure very low Fs drivers)
  - Measures Voice Coil and Suspension Compression Effects
  - RLC and Cable Measurement in 100pF-1000uF, 10nH-10H, .01-100K ohm Ranges
- Fast, < 1 Second, Real-Time Impedance & Phase (generic Impedance sweeps)
- 32 Dual Data Buffers for Testing and Overlays
- Line Level Outputs for Driver Break-in
- Zobel, T/S Tank & Air Core Inductor Calculators
- Export to ZMA, Bass Box, Leap, WOO and Text File Formats

## Thiele Small Driver Measurement

- Single Button Q/FS Tests
- Single Button Vas and Motor Parameters

Select from:  
Delta Mass,  
Delta Box or  
Efficiency

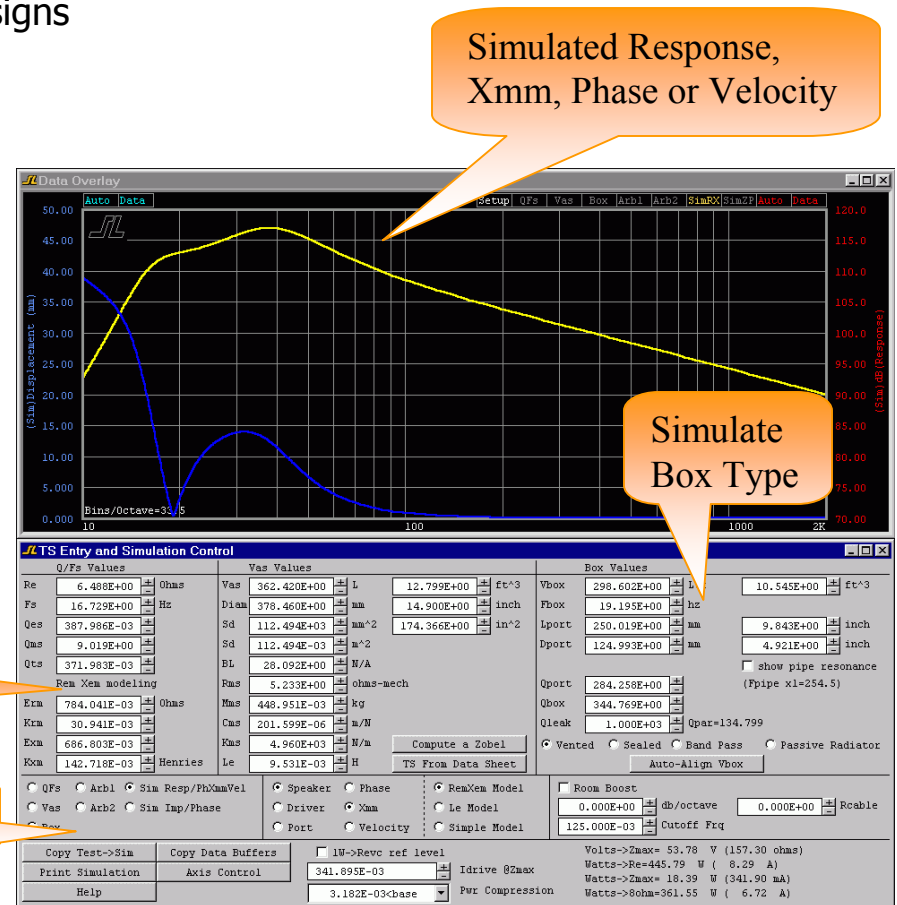


Re = 2.7341 ohms  
 Fs = 23.3032 Hz  
 Zmax = 91.5429 ohms  
 Qes = 0.2836  
 Qms = 9.2124  
 Qts = 0.2751  
 Le = 5.4490 mH (at 1 kHz)  
 Diam = 388.6200 mm ( 15.3000 in )  
 Sd = 118615.1505 mm<sup>2</sup>(183.8539 in<sup>2</sup>)  
 Vas = 196.2490 L ( 6.9305 ft<sup>3</sup>)  
 BL = 25.3967 N/A  
 Mms = 458.6490 g  
 Cms = 98.1890 uM/N  
 Kms = 10184.4453 N/M  
 Rms = 6.5412 R mechanical  
 Efficiency = 0.8228 %  
 Sensitivity = 91.1708 dB @1W/1m, 95.8336 dB @2.83Vrms/1m  
 Fs/Fsa = 1.1524  
 Ideal Mass = 257.9901 g  
 Mass used = 150.5000 g  
 ;--- Impedance Fitting Constants ---  
 Krm 12.322E-03 ohms Freq dependent resistance  
 Erm 821.518E-03 Rem=Krm\*(2\*pi\*f)^Erm  
 Kxm 77.654E-03 Henries Freq dependent reactance  
 Exm 694.353E-03 Xem=Kxm\*(2\*pi\*f)^Exm,

# The Woofer Tester 2

## Advanced Thiele Small Simulator & Box Analyzer

- Import and Simulate T/S Test Data (or Mfr Data)
- Vented, Sealed, Band Pass or Passive Radiator Designs
- Response, Impedance, Phase, Velocity & Xmm
- Frequency Dependent Inductance Model
- Box, Port and Stuffing Losses
- Room/Car Pressurization Effects
- Vent Resonance (Pipe Organ) Effects
- Simulate Measured Driver Compression Effects



T/S Model Data

Import Data, Copy & Print

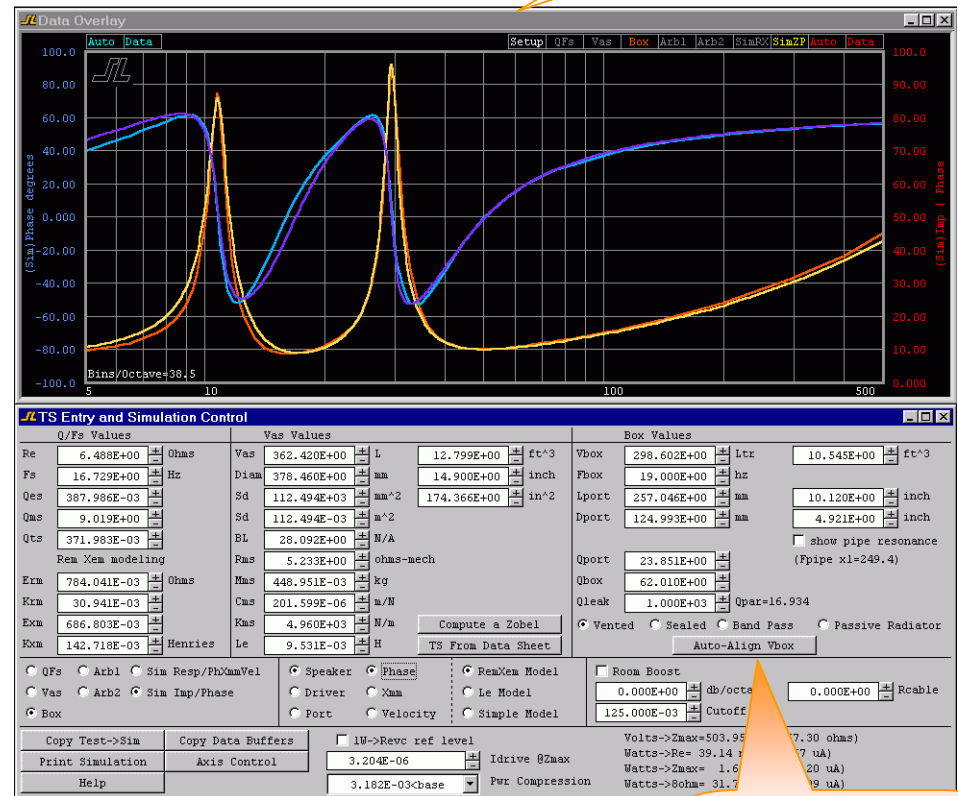
## Box Alignment

- Measures In-Box Electrical Impedance (Box Test Button)
- Finds Traditional Fsb, Ha and Alpha Values (traditional method)

### NEW BOX ANALYSIS METHODS

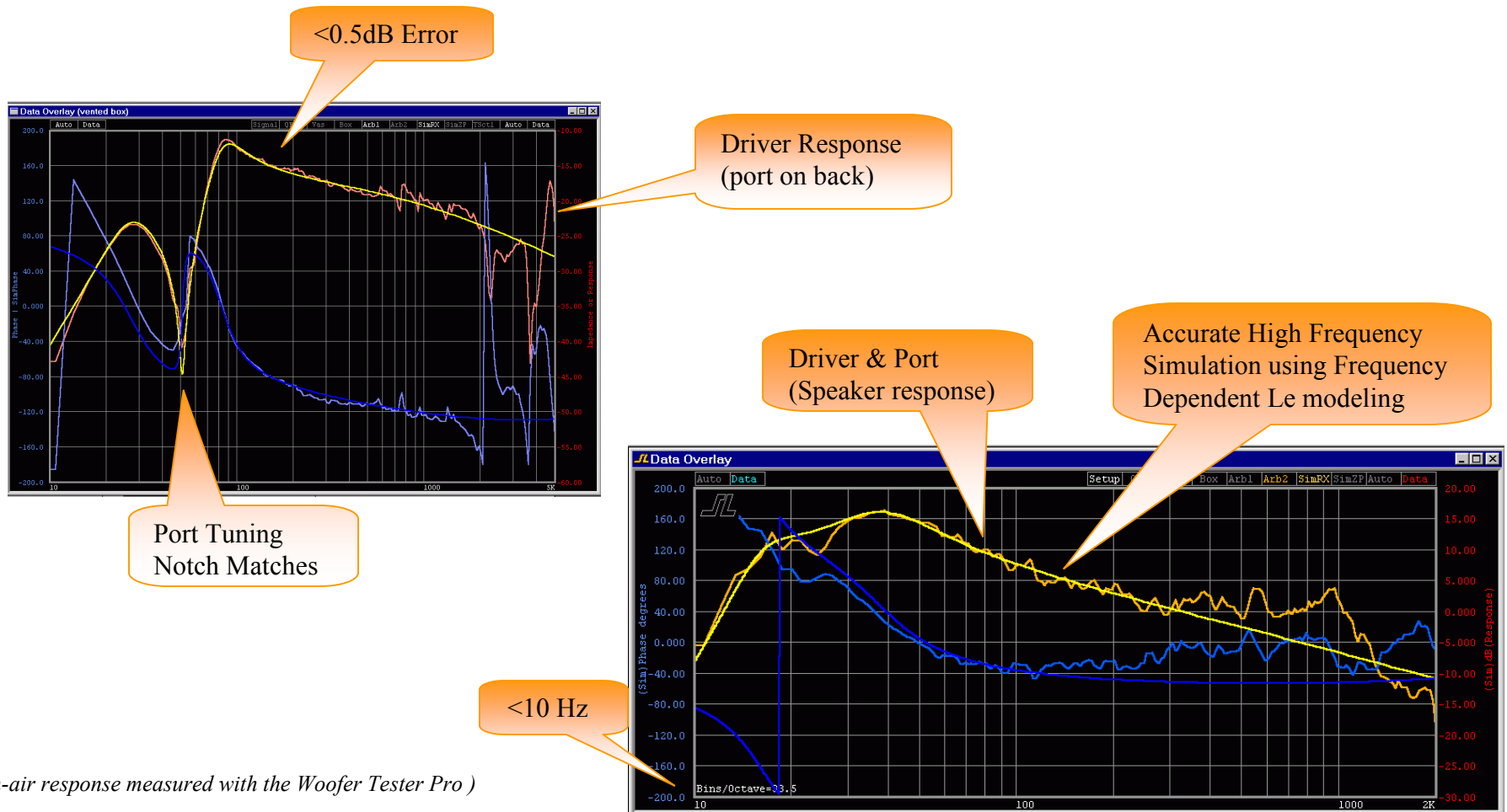
- Automatically Align Simulator and Measured Box Data to Find Effective Box Size, Tuning and Losses
- Refine driver parameters even if they have shifted due to drive level, temperature, break-in or box and driver interaction

BoxZP and SimZP Overlay



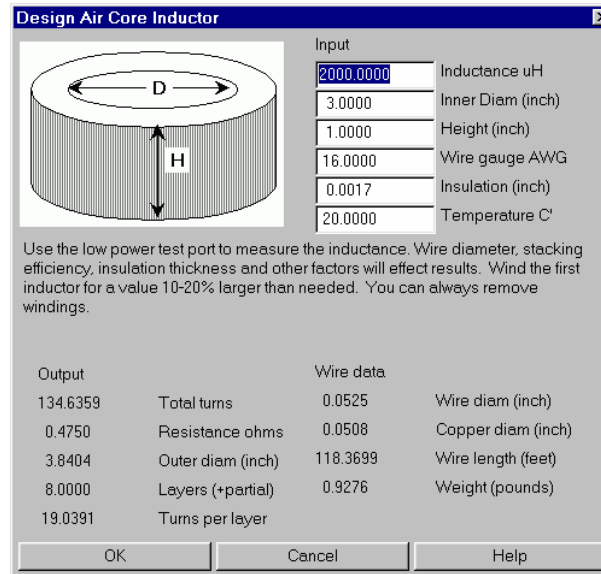
Box Auto-Align

## Actual Box-Aligned Simulation vs. Response



## Speaker Builder's Toolkit

- Design Air Core Inductors
- Measure Small and Large Capacitors
- Ellipsoid Area Calculator
- Calculate Acoustic Constants



**Design Air Core Inductor**

Input

2000.0000	Inductance uH
3.0000	Inner Diam (inch)
1.0000	Height (inch)
16.0000	Wire gauge AWG
0.0017	Insulation (inch)
20.0000	Temperature C'

Use the low power test port to measure the inductance. Wire diameter, stacking efficiency, insulation thickness and other factors will effect results. Wind the first inductor for a value 10-20% larger than needed. You can always remove windings.

Output

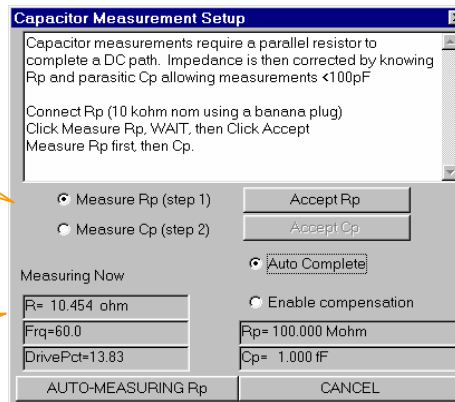
134.6359	Total turns	0.0525	Wire diam (inch)
0.4750	Resistance ohms	0.0508	Copper diam (inch)
3.8404	Outer diam (inch)	118.3699	Wire length (feet)
8.0000	Layers (+partial)	0.9276	Weight (pounds)
19.0391	Turns per layer		

OK Cancel Help

Design Air Core Inductors

Winding Info

Wire Stats



**Capacitor Measurement Setup**

Capacitor measurements require a parallel resistor to complete a DC path. Impedance is then corrected by knowing Rp and parasitic Cp allowing measurements <100pF

Connect Rp (10 kohm nom using a banana plug)  
Click Measure Rp, WAIT, then Click Accept  
Measure Rp first then Cp.

Measure Rp (step 1)  Measure Cp (step 2)

Measuring Now

R= 10.454 ohm	Accept Rp
Frq=60.0	Accept Cp
DrivePct=13.83	Auto Complete
	Enable compensation
	Rp= 100.000 Mohm
	Cp= 1.000 fF

AUTO-MEASURING Rp CANCEL

Automatic Calibration

100 pF Pico Farad Range

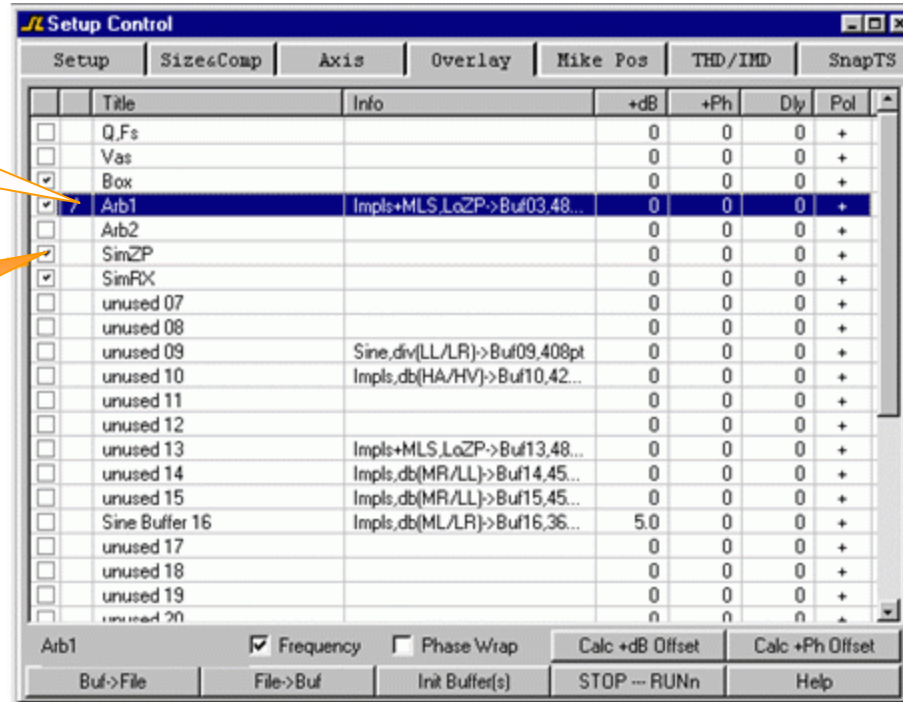
Measure Small Capacitors < 100 pF

## 32 Dual Buffers for Testing & Overlays

- Each Buffer Stores Two Data Points: (Impedance, Phase, Response, Displacement, Velocity)
- Easy Setup and Control from One Place
- Set Response and Phase Offsets, Phase Wrapping and Polarity
- Tester Automatically Calculates Difference Between Measured and Desired Value

ARB1 is Data Destination from Main Control Window

Buffers Displayed in Overlay Window: Box, ARB1, SimZP and SimRX

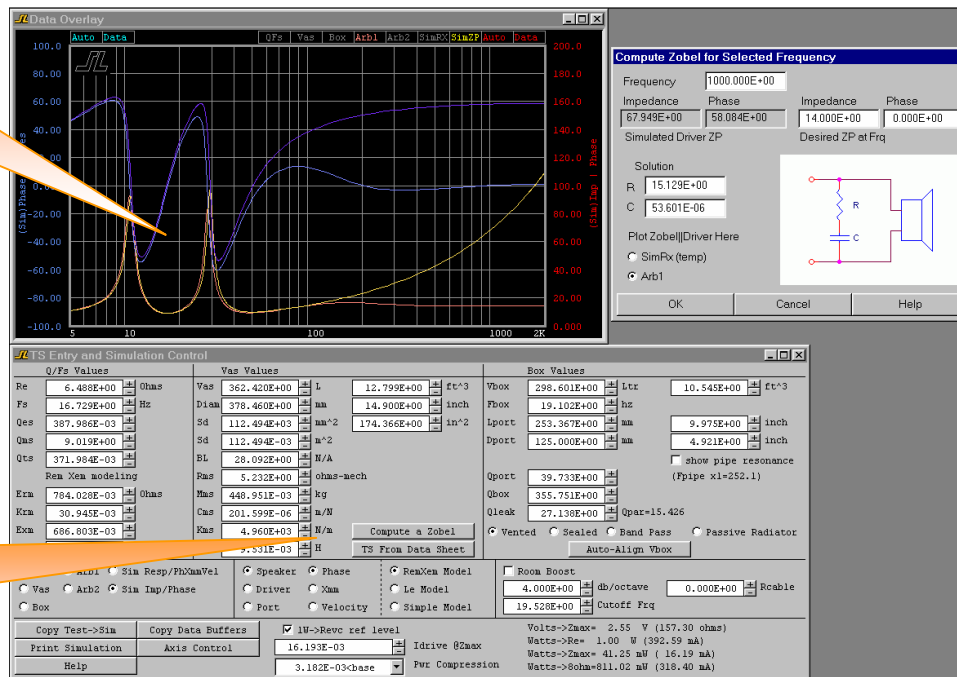




## Zobel Compensation Networks

- Simple 'of the shelf' Crossovers Assume Resistive Loads
- Zobel Networks Make Voice Coil Inductance Look Resistive

Overlay Original and Zobel Compensated Impedance plots



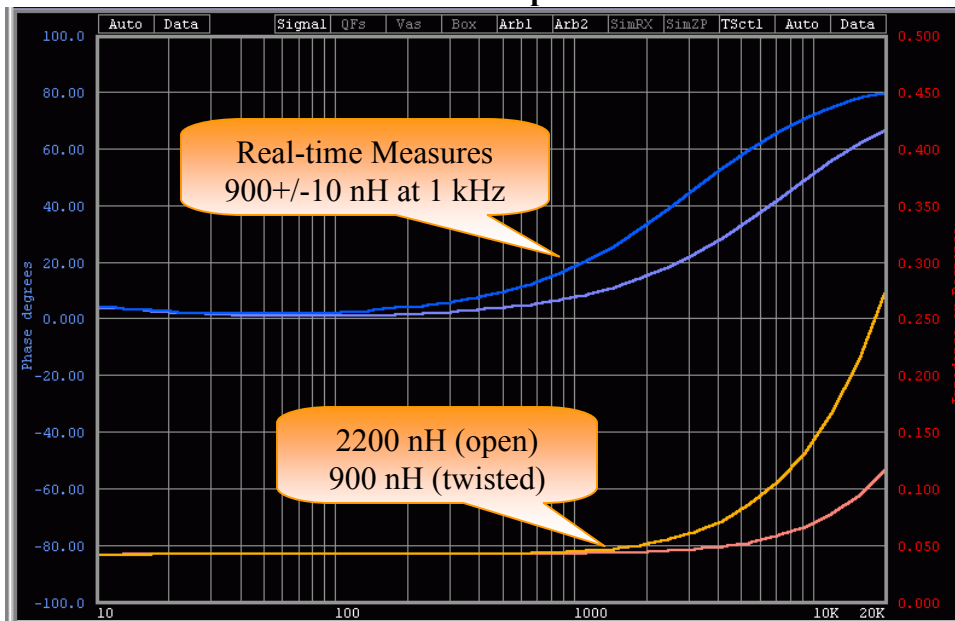
Select Frequency and Target Impedance

Start Zobel Tool or Enter T/S from Mfr Data

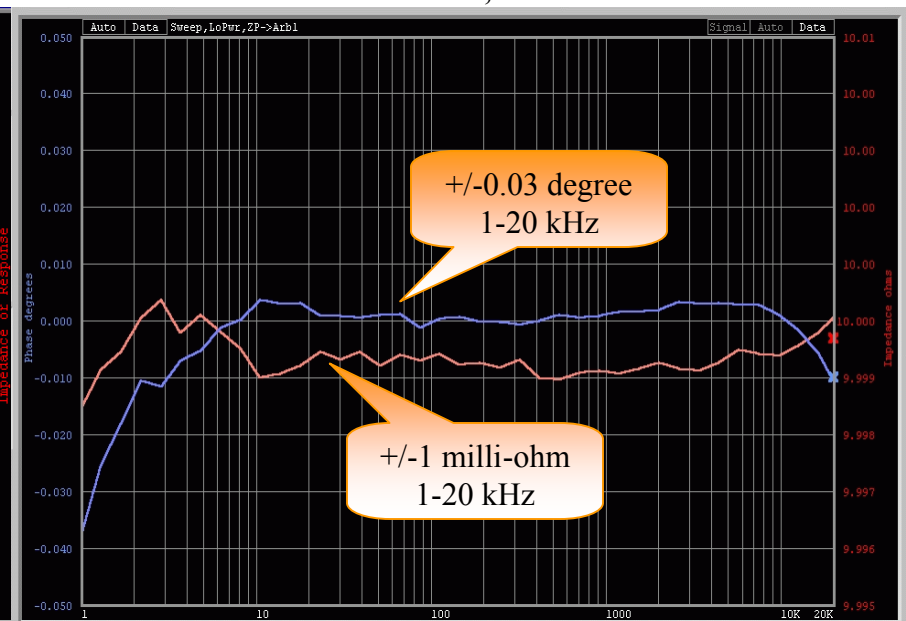
## Measure any Crossover Component or Cable

- Measure Resistance, Inductance and Capacitance
  - Continuous 1 to 20 kHz Measurement Range
  - 0-3 mA Constant Current Range
  - 5 Digit Accuracy at Full Scale
  - Easily Measures Speaker Cables
  - 100pF-1000uF, 100nH-10H, 10 milli-ohm to 1M-ohm range

$\Delta$  Inductance of 36" Leads Open/Closed 50 m $\Omega$ /div



10 ohm cal resistor: 1 m $\Omega$ /div, 1-20 khz



## Tester Comparison Matrix

Feature	Woofer Tester 2	Speaker Tester	Woofer Tester Pro
Precision Thiele-Small Measurement	•	•	•
VAS Test with Phase Plug Area Calculation	•	•	•
Thiele-Small Simulator	•	•	•
Automatic Box Analysis	•	•	•
RLC Meter	•	•	•
Low Power Impedance Measurement	•	•	•
Low Power AC/DC Compression Testing	•	•	•
Sine, Impulse, MLS, Noise & Chirp Test Signals	•	•	•
32 Dual Data Buffers for Testing & Overlays	•	•	•
Sweep and Real-Time Run, Stop and RunN Control	•	•	•
Interactive Crossover Design™		•	•
Real-time Acoustic Analysis (RTA)		•	•
Room Decay Measurement		•	•
Swept Sine In-Air Acoustic Response		•	•
THD/IM/SINAD Distortion Measurement		•	•
Cumulative Spectral Decay & Waterfall Plots		•	•
FFT Display		•	•
SnapTS™ Real-Time Thiele-Small Testing		•	•
Microphone Compensation for Signal & Reference		•	•
Impulse Time Gating		•	•
High Power Thiele-Small Measurement			•
High Power Impedance			•
High Power AC/DC Compression Testing			•
Speaker Linearity Testing			•
DC Bias Testing			•
High Power Box Compression			•
Calibration Option for Measurements at Cable Ends	•	•	•
Air-Core Inductor, Zobel & Tank Calculators	•	•	•
Popup Data Labels in Graphs	•	•	•
Customizable Legends	•	•	•
Mobile, USB powered	•	•	•

Low power is up to 3mA drive

High power is up to 40V, 5A, 200 watt amplifiers

# About Smith & Larson Audio

*Smith & Larson Audio* is based in the USA and is the home of the original Woofer Tester, which was introduced in 1995. It was redesigned in 2005 and is in use by over 1000 customers worldwide. In 2006, the product line and our test capabilities expanded and now include the Speaker Tester and Woofer Tester Pro. *Smith & Larson* has over 40 years of combined experience in audio design and digital signal processing.

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