

Micro Suspension Part Measurement

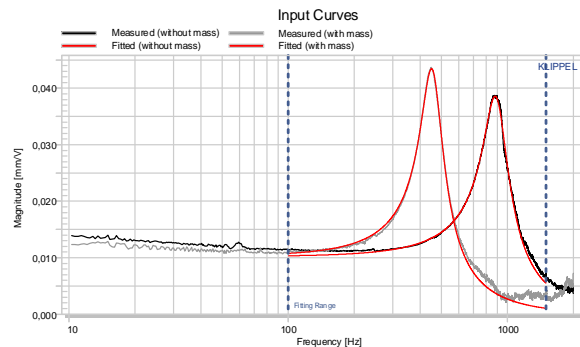
Module of the KLIPPEL ANALYZER SYSTEM (Document Revision 1.6)

FEATURES

- Linear Parameter Measurement: Stiffness K , Moving Mass m , Mechanical Resistance R
- Resonance Frequency & Q-Factor
- Measurement of bare membrane without attaching to a voice coil
- Suspension Parts of: micro-speakers, headphones, tweeters, microphones

BENEFITS

- Pneumatic excitation without electrical motor
- Specification of suspension parts
- Optimal driver design in R&D



Name	Value	Unit	Description
f_{reso}	896.39	Hz	Resonance Frequency
Q	3.74	-	Quality Factor
m	0.0176	g	Moving Mass
C	1.7872	mm/N	Mechanical Compliance
K	0.5595	N/mm	Stiffness
R	0.0265	kg/s	Mechanical Resistance

DESCRIPTION

The *MSPM Lite Micro Suspension Part Measurement* software module and hardware accessory for the KLIPPEL R&D System is designed for the measurement of the small signal parameters of small suspension parts (Micro-speakers, headphones, tweeters, microphones).

The membrane is excited passively by the sound pressure in a pressure chamber and the linear parameters: resonance frequency, Q-factor, stiffness, moving mass and mechanical resistance are determined dynamically by a simultaneous measurement of displacement and sound pressure.

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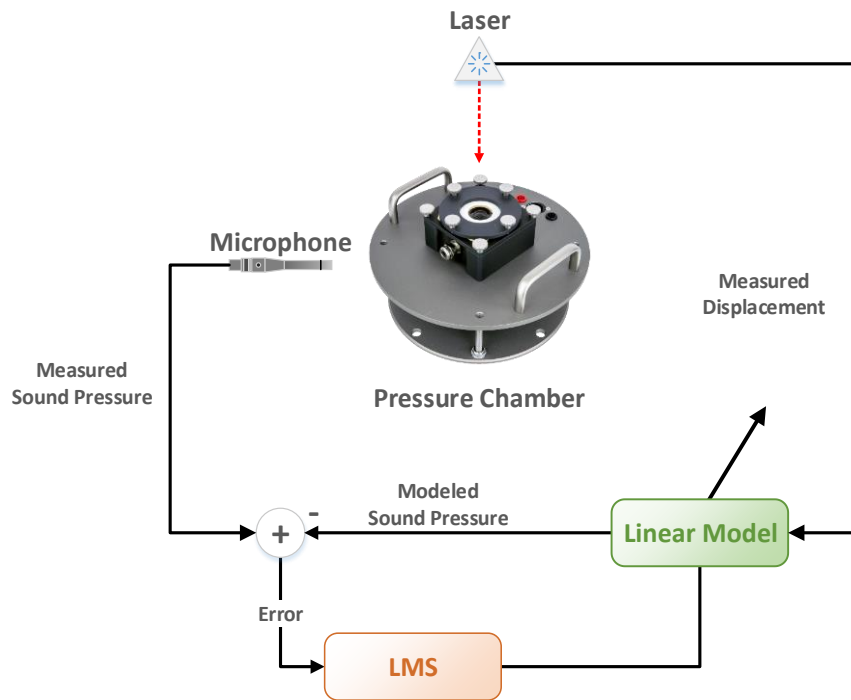
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1 Overview

1.1 Principle

Measurement Principle



The *MSPM Lite Micro Suspension Part Measurement* identifies the linear mechanical parameters of small membranes. The membrane is glued into a plate, which is mounted in the *MSPM Bench*.

During the measurement, the membrane is excited by sound pressure in the small pressure chamber. Sound pressure p inside the pressure chamber as well as displacement x of the membrane are captured during the measurement. The resulting transfer function is modeled by a spring mass system, using resonance frequency and quality factor. Using the resonance shift by adding a known mass (*Added Mass Method*), or by entering the known value of the moving mass, the linear parameters may be calculated.

1.2 Results



Resonance Frequency / Quality Factor

Using the *MSPM Lite*, the resonance frequency as well as the quality factor of the membrane can be determined.

Linear Parameters

By either using the *Added Mass Method*, or by importing a known moving mass, the linear mechanical parameters resistance R , stiffness K and moving mass m can be calculated.

2 Requirements

2.1 Hardware		
MSPM Bench (Art. #2500-601)	MSPM Bench comprises a small pressure chamber with a flexible clamping mechanism for micro suspension parts.	
Analyzer	The <i>Klippel Analyzer 3</i> or the <i>Distortion Analyzer</i> are used as hardware to control the laser head and to perform the measurement.	
dB-Lab (>210.124)	Project Management Software of the KLIPPEL R&D SYSTEM.	
TRF-Module	Software Module for Transfer Function Measurements with the KLIPPEL Analyzer devices.	
Laser Stand	The MSPM Bench is designed to work with one of the following laser positioning devices <ul style="list-style-type: none"> • 3D Scanner (Scanning Vibrometer System SCN) (Art. #:2510-004) • LST Bench (Art. #: 2500-310) + Translation Stage (Art. #:2300-001) • Pro Driver Stand (Art. #:2211-100) + Translation Stage (Art. #:2300-001) 	
Laser Displacement sensor	A high precision laser displacement sensor is required. It is recommended to use: <ul style="list-style-type: none"> • Keyence LK-H052 Laser sensor (Art. #:2103-200) 	
Microphone	A 1/4" microphone is required for sound pressure measurement in the pressure chamber. Recommended Product: <ul style="list-style-type: none"> • MIC 40PP-S1 (Art. #:2400-007) 	
Amplifier	A power amplifier is required for performing the measurement.	
Computer	A personal computer is required for performing the measurement.	
2.2 Software		
dB-Lab (>210.128)	dB-Lab is the project management software of the KLIPPEL R&D SYSTEM.	

3 Limitations

3.1 Device Under Test				
Parameter	Min	Typ	Max	Unit
Dimension	DUT Dimensions can be found in <i>A12 MSPM Bench</i>			
Resonance frequency	100		2500	Hz
Cone Breakup Frequency ¹	600			Hz
3.2 Sensors				
Laser	Laser limitations can be found in <i>A2 Laser Displacement Sensor</i>			
Microphone	Microphone limits can be found in <i>A4 Microphones</i>			

4 Outputs

4.1 Result Curves		
Input Curves	The window shows the measured transfer function $H_{X/P}$ with and without mass.	
4.2 Result Parameters		
Parameter	Unit	Description
f_r	Hz	Resonance frequency of suspension part
Q	-	Quality factor of suspension part
m	g	Moving mass
C	mm/N	Mechanical compliance
K	N/mm	Mechanical stiffness
R	kg/s	Mechanical resistance

¹ Negligible partial vibrations below the stated frequency

5 MSPM Bench Specification

5.1 Specification for 1.0 and above

5.1.1 Maximum/Minimum Ratings	Min	Max	Unit
Driver Nominal Impedance	8		Ω
Input Voltage (continuous, <40s)		12	V
Input Voltage (short term, <5s)		19	V

Driver used: 18 Sound 6ND410

6 References

6.1 Related Modules	MSPM Pro, SPM Lite, LST Lite
6.2 Manuals	MSPM Manual

Find explanations for symbols at:

<http://www.klippel.de/know-how/literature.html>

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Designs and specifications are subject to change without notice due to modifications or improvements.

