MSPM Lite C10

Micro Suspension Part Measurement

Module of the KLIPPEL ANALYZER SYSTEM (Document Revision 1.7)

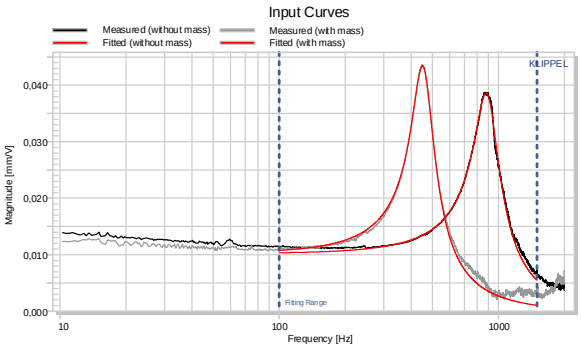
FEATURES

- 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.

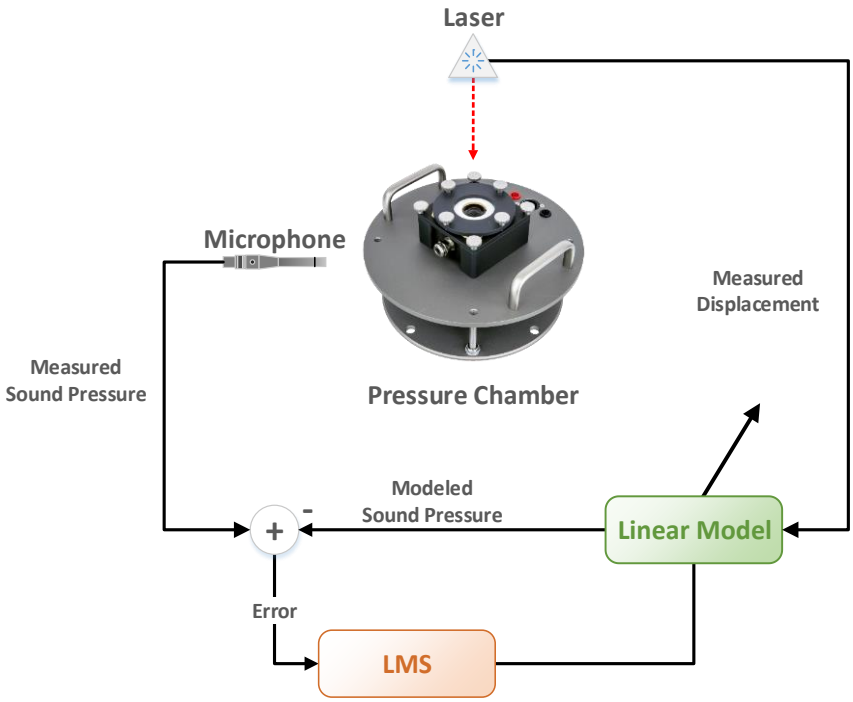
Article number	#2500-603

CONTENT

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 *Klippel Analyzer 3* or the *Distortion Analyzer* are used as hardware to control the laser head and to perform the measurement.	
Laser Stand	The MSPM Bench is designed to work with one of the following laser positioning devices • 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: • 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: • MIC 40PP-S1 (Art. #:2400-007)	
Amplifier	A power amplifier is required for performing the measurement. The KA3 internal Amp Card	
Computer	A personal computer is required for performing the measurement.	

2.2 Software

dB-Lab (>=210.128)	Project Management Software of the KLIPPEL R&D SYSTEM.
TRF-Module	Software Module for Transfer Function Measurements with the KLIPPEL Analyzer devices.

3 Limitations

3.1 Device Under Test

Parameter	Min	Typ	Max	Unit
Dimension	DUT Dimensions can be found in *A12 MSPM Bench*			
Resonance frequency	100		2500	Hz
Cone Breakup Frequency[1]	600			Hz

3.2 Sensors

Laser	Laser limitations can be found in *A2 Laser Displacement Sensor*
Microphone	Microphone limits can be found in *A4 Microphones*

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
Last updated: April 29, 2021
Designs and specifications are subject to change without notice due to modifications or improvements.