# DCX Add-On for SPL and EQA task
## Dynamic Excursion Check and Control

S37

QC Add-On for SPL and EQA task of the KLIPPEL ANALYZER SYSTEM
(QC Ver. 7, dB-Lab Ver. 212)

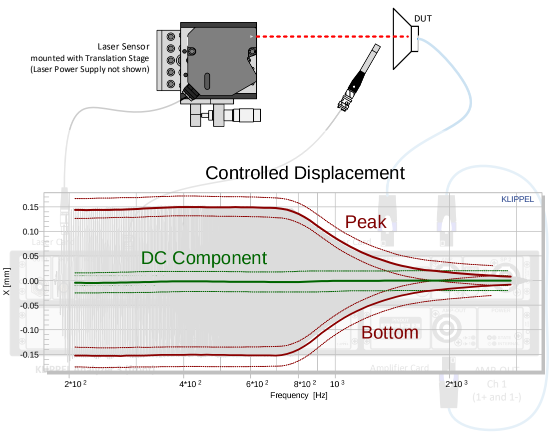
Document Revision 1.2

### FEATURES

- Check excursion at EoL using laser
- Check peak / bottom excursion
- Check dynamic DC component
- Define AC and DC target excursion for tests

### BENEFITS

- Ensure critical and well-defined excursion for distortion tests
- Check instability of coil offset
- Contact free excursion check




### DESCRIPTION

The DCX Add-On is an optional extension for the SPL and the EQA-Task of the Klippel QC-Software. It expands the acoustic test capabilities of both tasks with laser measurement capability of transducer excursion. Mechanical excursion testing is a valuable method to check the maximal displacement and the frequency dependent voice coil or diaphragm position. Note that also electrical methods based on modeling can assess those parameter (MSC module).

The SPL task with DCX Add-On can check the envelope, the peak/bottom excursion and the dynamically generated offset of the coil position, which is a crucial property of voice coil stability.

The EQA task with DCX Add-On can control the excursion of any transducer to a given target envelope and even compensate for dynamic coil offset. A maximum excursion can be defined and a level profile derived that can be applied in a following measurement step by the SPL task for actual measurement. Since excursion is a dominant cause of nonlinear distortion, critical distortion tests can be designed that represent a worst-case operation scenario.

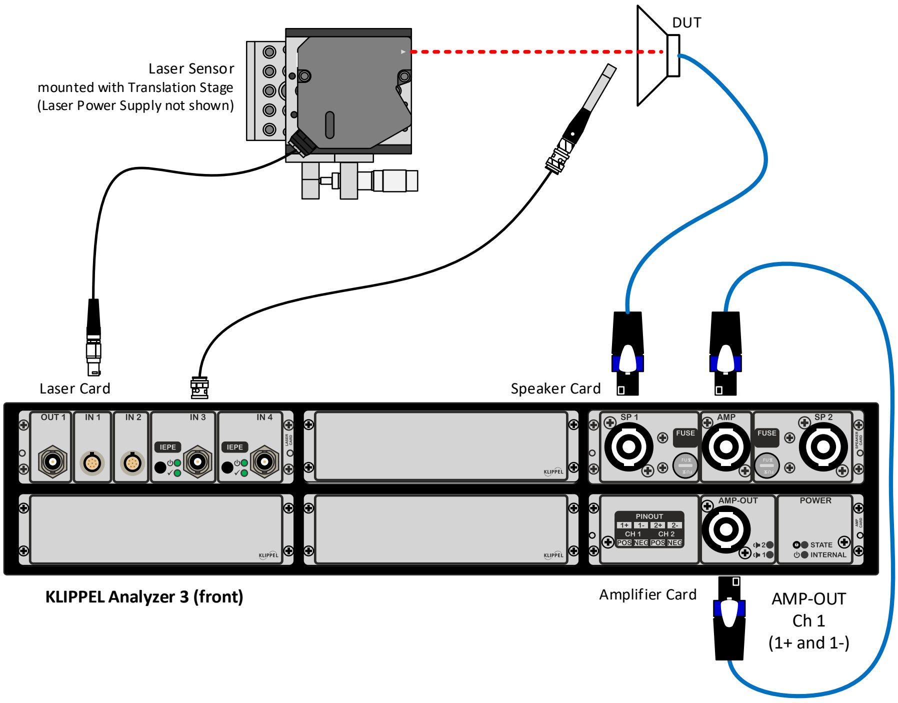
## CONTENT

# 1 Examples

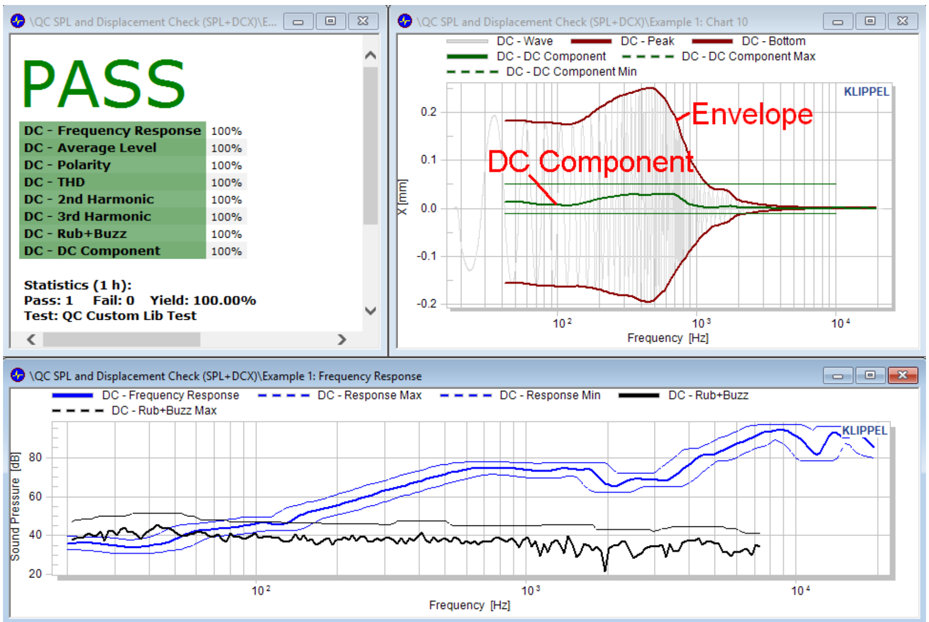
## 1.1 Voice Coil DC Component Check of a Micro-Speaker (SPL-Task)

Setup

Transducer testing can be extended by a laser sensor in addition to a microphone and V/I testing for impedance. The excursion and derived properties (envelope, dynamic DC component) can directly be measured.




Results




The upper right chart shows excursion-based results derived from the measured waveform of a typical micro-speaker. In this example the dynamic coil position (labeled: DC Component) is checked against constant, user defined limits.

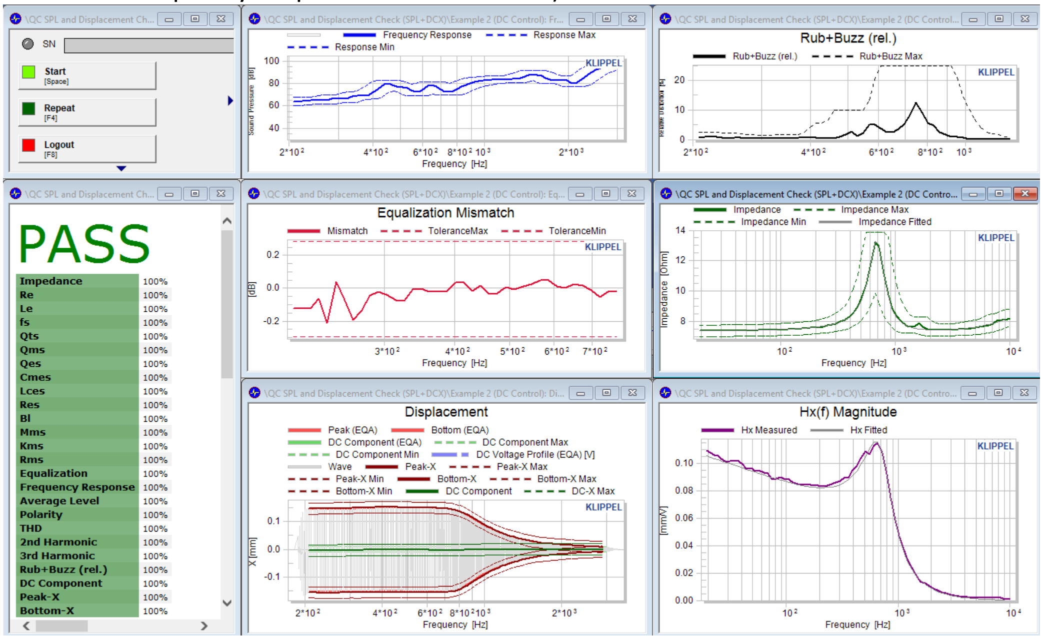
### 1.2 Displacement Control for Micro-Speaker Testing (EQA + SPL Task)

**Results**

The setup is identical to the first example above.

In addition to testing the displacement waveform envelope and DC component, those excursion properties can also be controlled by the EQA task with DCX Add-On automatically to match user defined properties (such as define peak displacement or envelope and/or also compensating DC components ensuring a symmetric waveform). Both, AC and DC voltage profiles are calculated by the EQA task. The resulting equalization profiles can be exported on-line to the SPL task in order to test under controlled displacement conditions. This displacement-controlled operation of the DUT can be used to check distortion (e.g. Rub&Buzz) for a defined and critical excursion pattern.

The lower left chart shows the controlled displacement (compare with the natural excursion in the first example of the same micro-speaker). The acoustic properties (top charts for frequency response and Rub&Buzz) are based on the controlled excursion.




## 2 Requirements

### 2.1 Hardware

- KA3 Hardware with Laser Card (see spec H3)
- Power Amplifier (QC-Card, AMP-Card, external power amplifier)
- Laser Displacement Sensor (see spec A2)
- Optional: Adjustment Gear for calibration:
  - Micro-speaker clamping
  - Translation stage

### 2.2 Software

- QC Standard Software 6.2 or SPL-Task license for R&D application (dB-Lab 210.560)
- EQA-Task License (if control is required)
- DCX Add-On is not available in QC Basic software.

# 3 Limitations

| | |
|---|---|
| Hardware | Laser testing on the production line is challenging:<br>• Proper SNR of the laser signal must be ensured (sufficient reflection from DUT surface).<br>• Laser sensors are optical device and prone to dust and dirt<br>• The DUT must be mounted in the working range of the laser sensor (proximity depends on sensor model). The absolute distance can be ruled out by software.<br>• The maximum applicable voltage for control can be defined to avoid overvoltage damage to the DUTs. |

# 4 Parameter, Limits and Results

## 4.1 SPL Task Parameters

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|---|---|
| DC Voltage Profile | Defines a variable DC (or better: very low frequency) bias voltage over sweep frequency that is added to the AC stimulus signal. |
| DCX - Offset Compensation | Defines method for static DC offset compensation in measured displacement envelope and DC component (absolute displacement reference). This is used to remove bias due to absolute laser position.<br>Options are:<br>• DC value measured at high frequencies<br>• DC value measured at low frequencies<br>• specified value<br>• none |
| DCX - Offset Value | Defines absolute (static) displacement offset. |
| DCX - Smoothing | Defines smoothing for all 3 result curves. |

## 4.2 SPL Task Results

| | |
|---|---|
| DCX - DC Component<br><br>DCX - Peak<br><br>DCX - Bottom | The result curves versus frequency are displayed in chart *Displacement*.<br>Available limit calculation modes for all 3 curves are<br>• Shifting Limits<br>• Statistics (Standard Deviation), also combined with Shifting Limits<br>• Absolute (Absolute Limits), also combined with Shifting Limits<br>• Jitter<br>Reference measurements may be also imported from external sources.<br>Control Rules can be applied. |

## 4.3 EQA Task Parameters

| | |
|---|---|
| DC Voltage Profile | Defines a variable DC (or better: very low frequency) voltage over sweep frequency that is added to the AC stimulus signal. |
| Max DC Voltage | Maximal allowed DC voltage at speaker terminals (or line out) that may be applied during automatic removal of DC displacement. Avoids damage to DUT. |
| DC - Offset Compensation | Defines method for static DC offset compensation in measured displacement envelope and DC component (absolute displacement reference). This is used to remove bias due to absolute laser position.<br>Options are:<br>• DC value measured at high frequencies<br>• DC value measured at low frequencies<br>• specified value<br>• none |
| DCX - Offset Value | Defines absolute (static) displacement offset. |
| DC – Smoothing | Defines smoothing for all 3 result curves. |

| | |
|---|---|
| DCX - Remove DC | Activates compensation of (dynamic) DC component in displacement waveform. |
| DCX - Hx(0) | optional parameter if *Remove DC* activated.<br>Specifies typical transfer factor (Hx=X/U @ DC in mm/V) for DC control. |

### 4.4 EQA Task Results

| | |
|---|---|
| Level Profile (AC) | Voltage versus frequency to match specified target AC displacement |
| DC Voltage Profile | Voltage versus frequency to compensate dynamic DC component |

## 5 References

### 5.1 Related Modules

- EQA Task
- SPL Task
- 3DL Add-On
- MSC Task

### 5.2 Manuals

- DCX Add-On User Manual
- EQA User Manual
- QC User Manual (includes manual for SPL task)
- MSC User Manual

### 5.3 Specifications

- A2 - Laser Displacement Sensor
- H3 - KA3
- C3 - QC Set
- S33 - QC EQ & Alignment
- S13 - QC MSC

### 5.4 Literature

W. Klippel: Loudspeaker Nonlinearities – Causes, Parameters, Symptoms. J. Audio Eng. Soc. 54, No. 10 (2006), 907-939

W. Klippel, S. Irrgang, U.Seidel, "Loudspeaker Testing at the Production Line" presented at the 120 Convention of the Audio Engineering Society, Paris, France , 2006 May 20-23, Paris.

W. Klippel End-Of-Line Testing, Assembly Line - Theory and Practice, Prof. Waldemar Grzechca (Ed.), InTech, DOI: 10.5772/21037. (2011). Available from: https://www.intechopen.com/books/assembly-linetheory-and-practice/end-of-line-testing

W. Klippel, J. Schlechter, "Fast Measurement of Motor Suspension Nonlinearities in Loudspeaker Manufacturing," Journal of Audio Eng. Soc., Vol. 58, No. 3, pp. 115-125, 2009 March

Find explanations for symbols at:

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

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