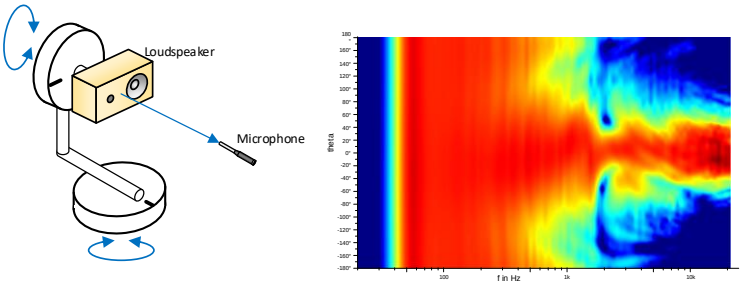
Directivity Measurement with Turntables AN54

Application Note to the KLIPPEL ANALYZER SYSTEM (Document Revision 1.7)

FEATURES

- Polar measurement in far field
- CEA2034 measurement
- Fast, automatic measurement
- Integrated in Klippel measurement system



DESCRIPTION

Fast and automated measurement of the directivity pattern of a loudspeaker is one of the most important features in the field of acoustics. The POL Module enables the user to measure the directivity of a sound source (e.g. a loudspeaker) using the TRF Module of the KLIPPEL R&D System. The user may choose between a one- or two-dimensional setup which presents the results in polar or balloon plots. The measured data can be analyzed in the visualization software exported to VACS, a program for viewing and post processing all kinds of acoustical data.

This Application Note gives step-by-step instructions on how to perform a measurement with a loudspeaker to obtain its directivity pattern using the POL and TRF Module of the KLIPPEL R&D System. It describes the hardware setup and gives valuable hints on how to obtain and interpret results. Furthermore, it is shown how the user may modify the setup to use other Modules than the TRF Module.

CONTENT

1 Requirements

1.1 Hardware

Required Hardware	• Klippel Analyzer 3 or Distortion Analyzer 2 • One or two turntables according to your own requirements • Microphone • PC
Setup	The hardware shall be connected the way you are used to perform a TRF. Please arrange the turntable(s), loudspeaker and microphone as shown in Figure 1:

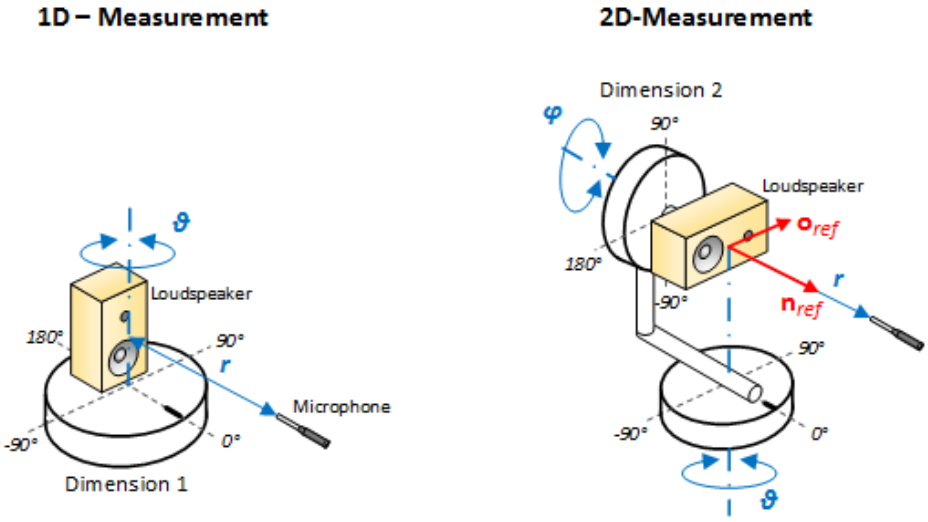


Figure 1: Hardware setup for the POL Module

The turntable 1 at the bottom is used as polar (ϑ-) axis. In the two dimensional setup a second turntable 2 for the circular (φ-) axis is arranged perpendicular to turntable 1.

The microphone needs to be positioned at the polar position of ϑ =0°. The loudspeaker driver should point into this direction as well. The position of the loudspeaker or device under test is the center of the turntable 1 (center of used coordinate system as well). Thus, r_{mic} is defined as the distance between the microphone and this center point of turntable 1. Please make sure that the distance r_{mic} does not change during the measurement.

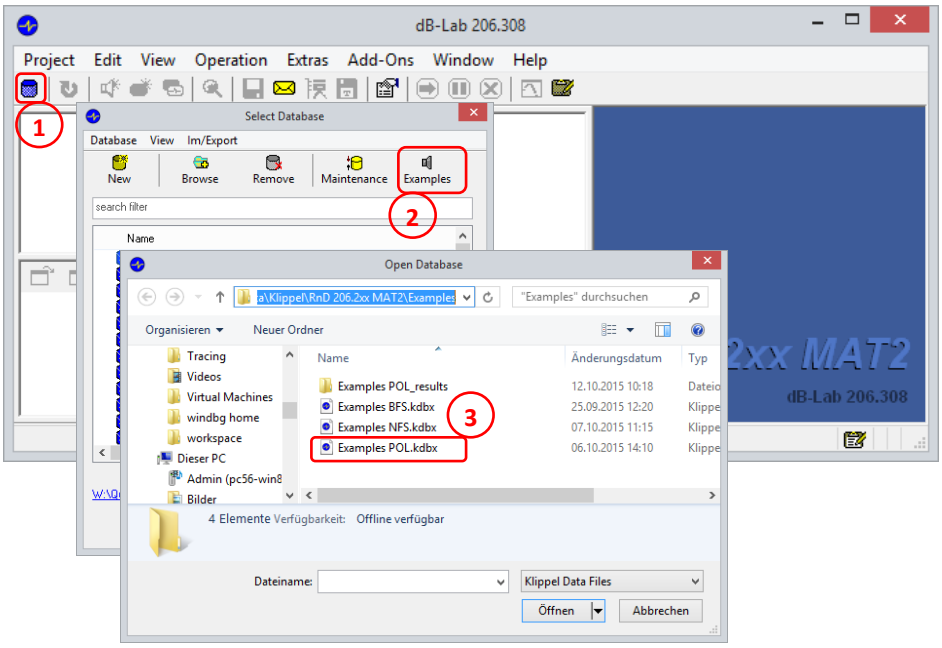
1.2 Software

Requirements	• dB-Lab • Robotics • POL – Polar Far Field Measurement – Software Module • TRF - Transfer function – Software Module • VACS Visualization Software [1] (Optional)

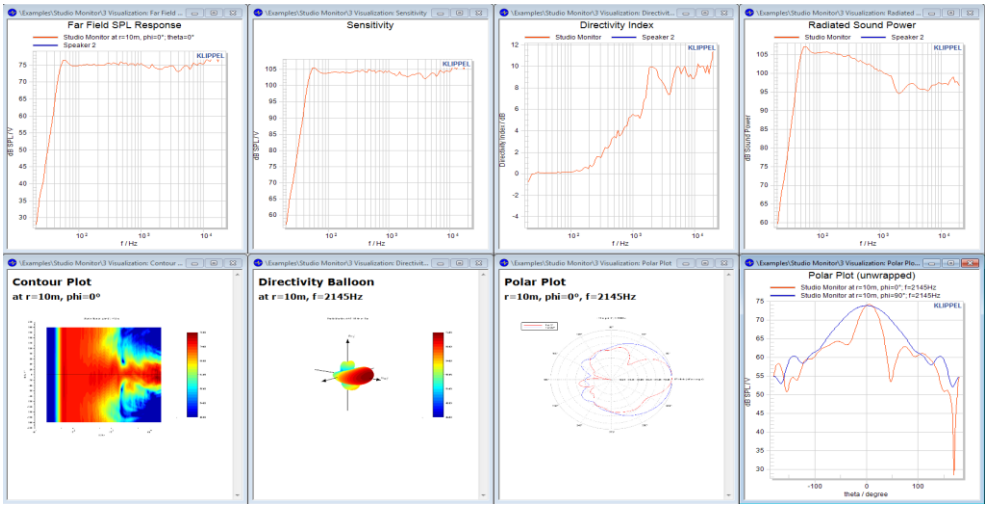
2 Viewing Example Measurement

Open Example Database

Open the Database selector, klick on *Examples*, and open the *Examples POL.kdbx* database. This Database shows a sample database.



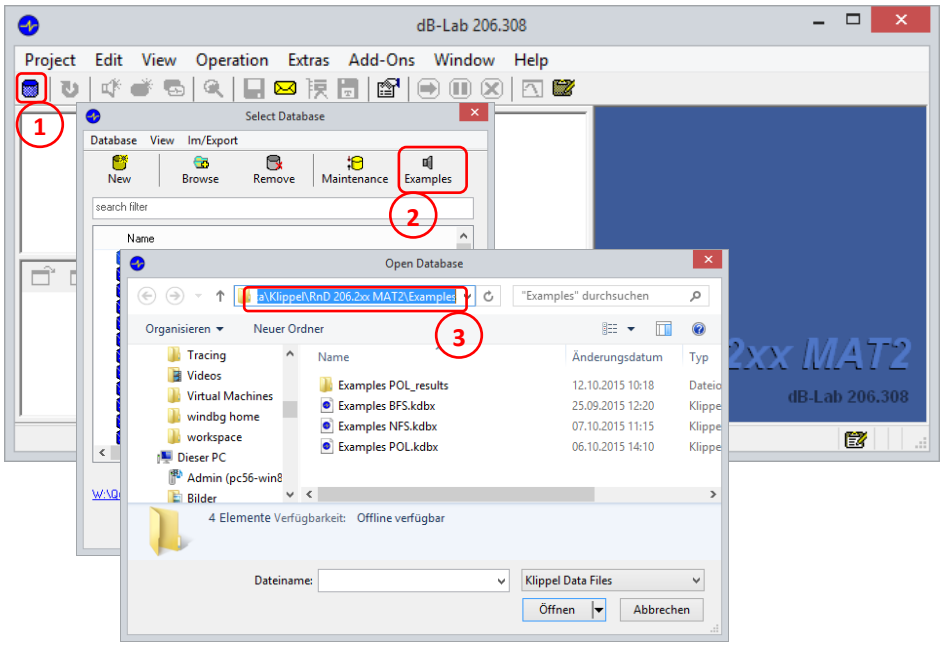
Select the operation Visualization to see the measurement results.



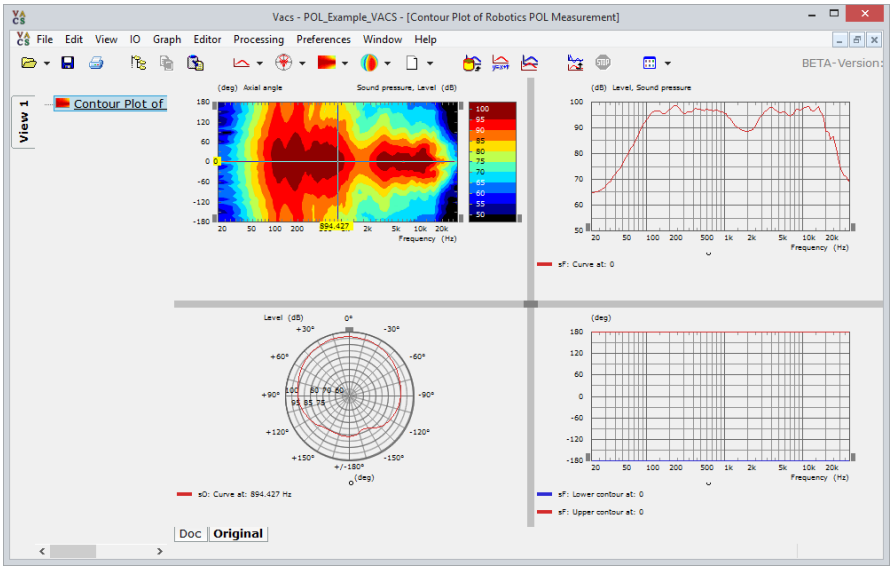
The analyze measurement data interactive run the operation.

Open Example in VACS

Open the Database selector, klick on *Examples*, copy the path and open it in the explorer. This folder includes the measurement data as ASCI data. And a sample VACS file [1].



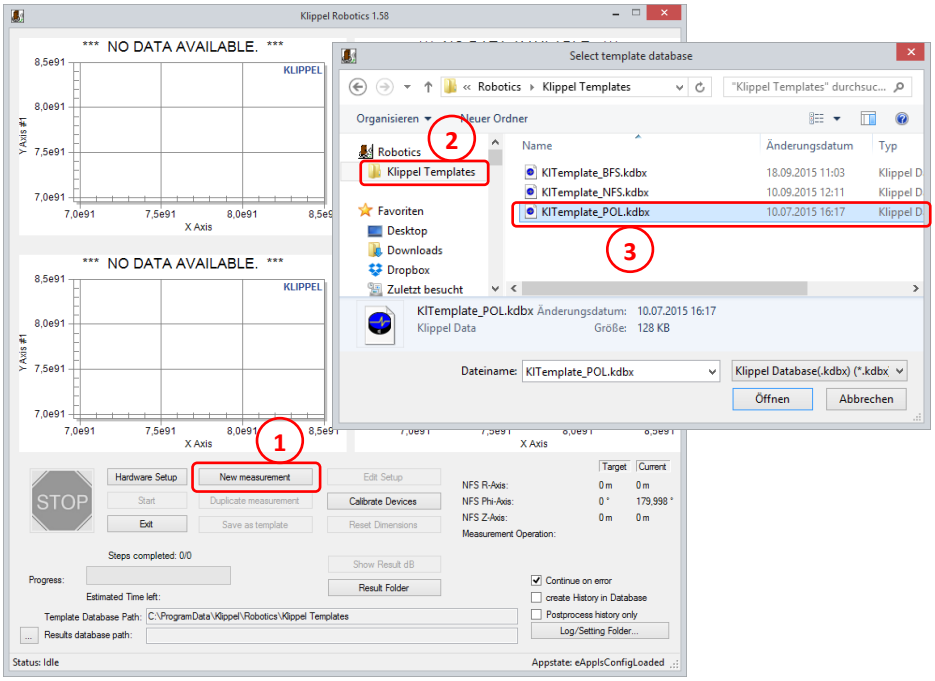
Install VACS [1] to open and view the data in VACS.



3 Conducting a polar measurement

Getting started

Start Robotics Software and set up a new POL measurement. Klick on *New measurement* and select the *KlTemplate_POL.kdbx* Template file

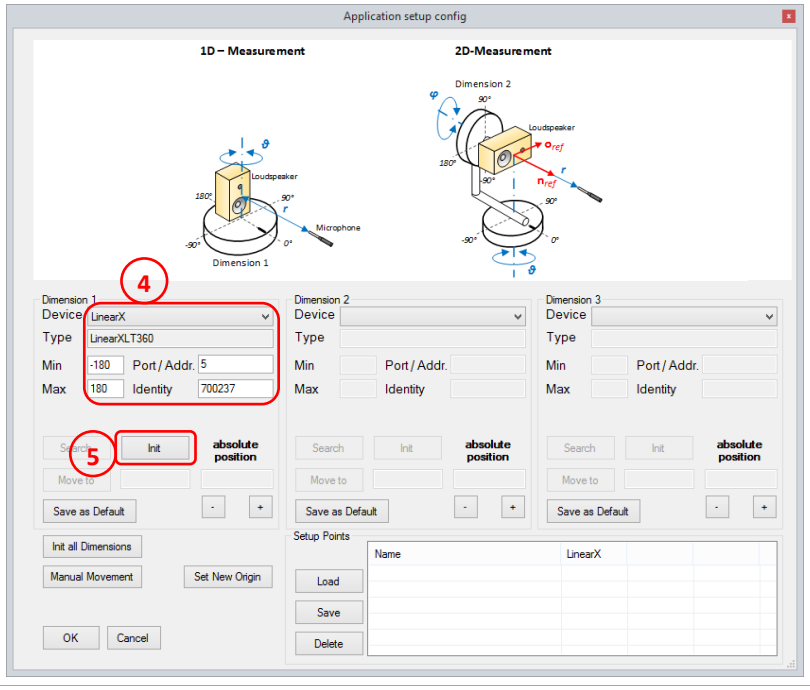


Hardware Setup

Select the hardware for *Dimension 1*, if you want to do a 1-dimensional measurement, or *Dimension 1* and 2 if you want to do a 2-dimensional measurement. *Dimension 1* corresponds to the turntable that performs the axial movement (φ-direction) and *Dimension 2* to the turntable that performs the polar movement (ϑ-direction). Select a blank device for all non-used dimensions, to avoid unwanted movement.

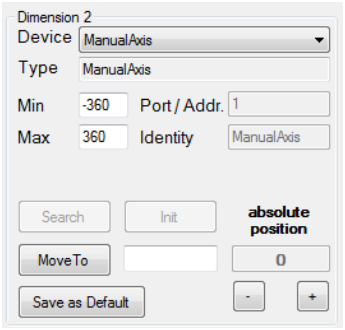
Enter the port for the device (for most devices this is the used COM port). Please read the Robotics Manual [2] for further reference on the port selection.

Click on *Init*, to initialize the device. You can now move the turntable, by entering an angle and clicking *Move to*.

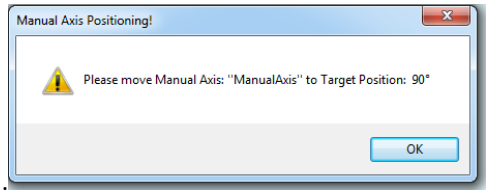


Manual Axis:

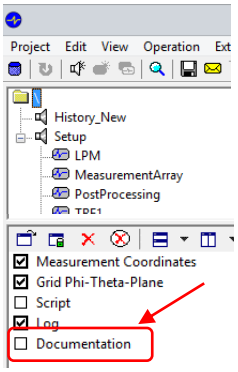
Especially the measurement of the CEA2034 spinorama requires the scanning of 2 polar scans. If only 1 turntable is available for the measurement, the rotation of the second axis (phi angle) can be performed by hand. To do this, please select in the hardware setup for dimension 2 the ManualAxis.



During the scan the Robotics Software will pop up a message box, when a manual positioning of the speaker is required.



Adjust Measurement Setup



Open the measurement setup, by clicking on the Edit Setup Button in the main window. dB-Lab will open with the Measurement Database.

Select the Measurement Operation *Setup/MeasurementArray* to configure the driving Job:

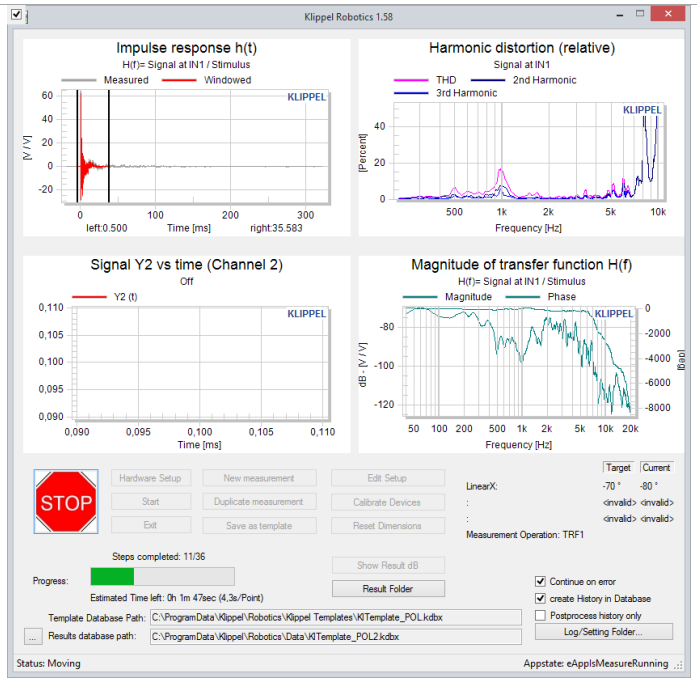
Define the measurement grid using the input parameters. You find the detailed description of the parameter in the "Documentation" window.

Select the Operation *TRF1* and adjust the parameters, as intended. Setup the Measurement Bandwidth, Measurement Voltage, windowing etc. Please find further Information in the TRF Manual [3]

Start Measurement

Before you start the measurement, please check the Checkbox *create History in Database*. The software will now keep a copy of every measured TRF operation for future reference.

Start the measurement and wait until it is finished. During the measurement the four diagrams in the Robotics main window will be updated after each measurement. This way you can have an online-view onto your measurement results.



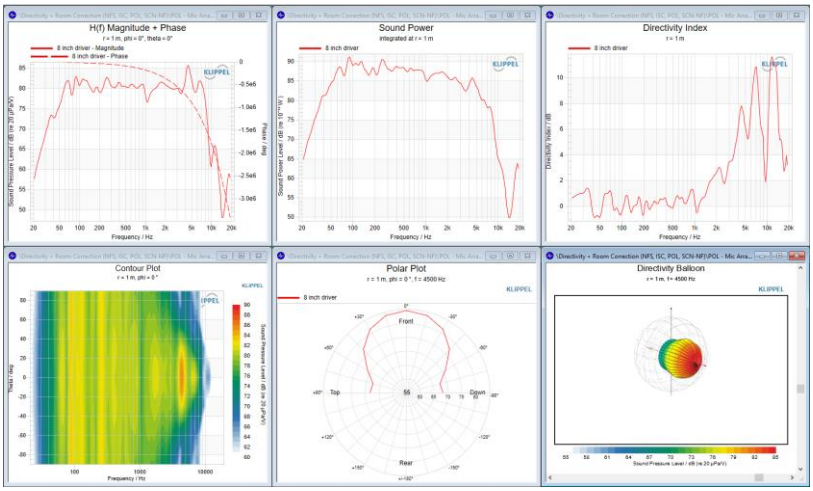
The measurement can be interrupted at any time, simply by pressing the *STOP* button. It can be continued afterwards by clicking the *Resume* Button

4 Viewing Results

Results in dB-Lab	After the end of the measurement task press the button Show Result dB. The software dB-Lab will open and you can continue with the Visualization.
Data Container	The database include the operation 'POL Data Container', where all measured curves are stores. To continue with the specific processing please select in the properties window the Export-format (e.g. CEA2034, Visualization) and the curve, which should be analyzed.
NFS Visualization	The visualization module of the Nearfield Scanner System can be used for the analysis of POL data as well. To do this, Select the Input Data Format Polar *Far-Field Measurement (POL)* and link the POL Data Container in the Properties Window.

Input Data Format	Near Field Scanner (NFS Field Identificatio...
	Polar Far-Field Measurement (POL)
Speaker 1	
	Select Operation
Operation	8 POL Data Container
Name	8 inch driver

After Running the operation the data can be analyzed interactively.



CEA2034	A special measurement task of the POL module is the CEA2034 measurement, which requires two POL scans. To calculate the specified curves from the standard automatically, the CEA2034 operation can be used. After running the operation the dB-Lab Result window shows the specific CEA2034 curves. 
Export Results to VACS	To view your data in VACS perform the following steps: Select in the Data Container the export format “VACS ASCII” and define the result path. After Running the data container, the exported curves from the results folder can be loaded into VACS, by using the Import functions.

5 References

[1]. VACS - Visualizing Acoustics Software http://www.randteam.de/VACS/Index.html

[2]. Manual Robotics

[3]. Manual TRF

Find explanations for symbols at:

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

Last updated: June 18, 2021