



# Balancing & Vibration Analysis

**Instruction manual 2022**



	Date	Type
DATABASE	30.01.2022 11:52	Dateio
Display	30.01.2022 11:52	Dateio
EULA.license	17.09.2020 09:43	LICEN
EULA.xps	21.09.2020 15:40	XPS-D
GPS.log	30.01.2022 11:59	Textdc
Microsoft.Win32.Registry.dll	19.10.2020 20:37	Anwei
NVH Analysis.exe	30.01.2022 11:32	Anwei
NVH_ABV_HW.bin	30.01.2022 10:43	BIN-D
NVH-Instruction Manual 2022.pdf	30.01.2022 11:27	Adobe
runtime.osx.10.10-x64.CoreCompat.Syste...	26.06.2019 10:36	Anwei
SinusInterface.log	30.01.2022 11:59	Textdc
System.Drawing.Common.dll	23.10.2021 01:51	Anwei
System.Reactive.dll	10.11.2020 16:22	Anwei
System.Runtime.CompilerServices.Unsaf...	23.10.2021 01:40	Anwei
System.Security.AccessControl.dll	23.10.2021 01:45	Anwei
System.Security.Principal.Windows.dll	19.10.2020 20:46	Anwei
System.Threading.Tasks.Extensions.dll	19.02.2020 10:05	Anwei
System.ValueTuple.dll	15.05.2018 13:29	Anwei

Starting with  
**NVH Analysis.exe**

**Important:** After copying the files to a folder, a **write permission** and a **change** permission must be given to this folder.

Open the windows explorer and with the right-mouse click open the **properties** and go to the **security** property of this folder.



## 1. Start Page

*Balancing & Vibration Analysis*

Supported Measurement devices

- Data Translation
- Apollo / Soundbook
- 2 Channel Audio-Device
- DataRec 4

LTT

Office

English

Start

Exit

Selection of a measuring system

The supported devices and the Office mode are only visible, if they are activated for the customer.

⇒ When they are purchased by the customer.

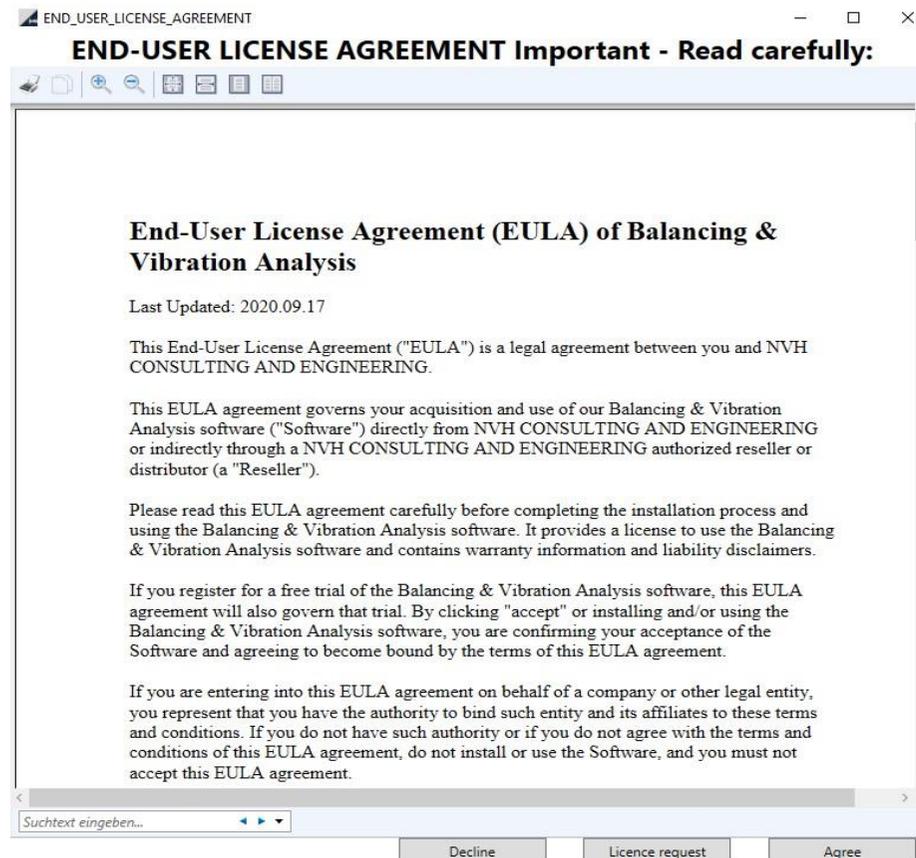
A measuring system must be selected on the start page. If Office is selected, the software works without a measuring device.

The language can be either German or English. Pressing Start takes you to the next page.



## 2. Activation of the software after installation

This procedure is started only once to activate the licence.



**When starting the software for the first time,  
you must sign the END-USER LICENCE  
AGREEMENT to use the programme.**

You must then enter an activation code.

After completing this procedure, you can use the software.

The details can be read at the end of this document.



In order to get a License key, you have to send the Licence request file

**NVH-LicenceRequest.NVA**

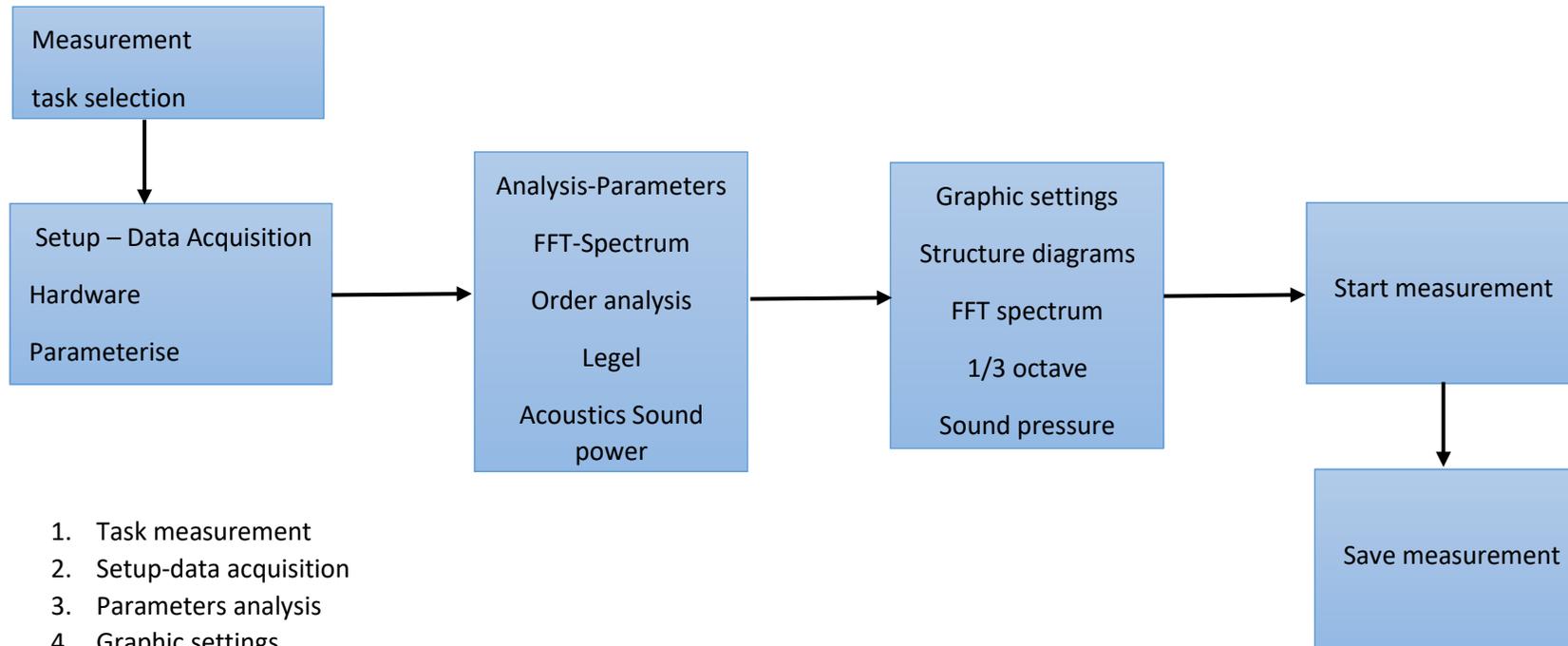
to the following E-Mail-Adress:

**dr-sibaei@sibaei-engineering.de**

After receiving the Licence-Key file you have to copy the Offline.LIC into the program folder.



### 3. Software flowchart



1. Task measurement
2. Setup-data acquisition
3. Parameters analysis
4. Graphic settings
5. START-Measurement
6. Save measurement

After selecting a measuring task, the modules are automatically called up one after the other.

The settings must be saved in each module so that these settings are called up the next time the programme is started.



## 4. Measurement task

The supported modules are only visible, if they are activated for the customer.

⇒ [When they are purchased by the customer.](#)

*FRF-Measurement*

*Vibration Orderanalysis and Acoustics*

*Monitoring Measurement*

*Dual Plane Balancing*

*Balancing Multiple plane*

Select

A measurement task is selected here.



## 4.1. Overview of the existing functions

### FRF- Transfer functions

<b>Signal</b>	Triggered Signalblock with 1024, 2048, 4096, 8192, 16384,32768,65536 Samples
<b>FFT-Spectrum</b>	FFT-Spectrum of Signal-Block
<b>FFT T-AVG</b>	Averaged FFT-Spectrum
<b>FRF-Ref 1 Mag</b>	Transfer function Magnitude for Reference 1
<b>FRF-Ref 1 Phase</b>	Transfer function Phase for Reference 1
<b>FRF-Ref 2 Mag</b>	Transfer function Magnitude for Reference 2
<b>FRF-Ref 2 Phase</b>	Transfer function Phase for Reference 2
<b>FRF-Ref 3 Mag</b>	Transfer function Magnitude for Reference 3
<b>FRF-Ref 3 Phase</b>	Transfer function Phase for Reference 3
<b>FRF-Ref 4 Mag</b>	Transfer function Magnitude for Reference 4
<b>FRF-Ref 4 Phase</b>	Transfer function Phase for Reference 4
<b>Kohärenz</b>	Coherence-Function
<b>INV FRF-Ref 1 Mag</b>	Inverse Transfer function Magnitude for Reference 1
<b>INV FRF-Ref 2 Mag</b>	Inverse Transfer function Magnitude for Reference 2
<b>INV FRF-Ref 3 Mag</b>	Inverse Transfer function Magnitude for Reference 3
<b>INV FRF-Ref 4 Mag</b>	Inverse Transfer function Magnitude for Reference 4
<b>FRF-Ref 1 Real-part</b>	Transfer function Real-Part for Reference 1
<b>FRF-Ref 1 Imag-part</b>	Transfer function Imaginary-Part for Reference 1
<b>FRF-Ref 2 Real-part</b>	Transfer function Real-Part for Reference 2
<b>FRF-Ref 2 Imag-part</b>	Transfer function Imaginary-Part for Reference 2
<b>FRF-Ref 3 Real-part</b>	Transfer function Real-Part for Reference 3



<b><i>FRF-Ref 3 Imag-part</i></b>	Transfer function Imaginary-Part for Reference 3
<b><i>FRF-Ref 4 Real-part</i></b>	Transfer function Real-Part for Reference 4
<b><i>FRF-Ref 4 Imag-part</i></b>	Transfer function Imaginary-Part for Reference 4
<b><i>FRF-Ref 1 Nyquist</i></b>	Transfer function Nyquist for Reference 1
<b><i>FRF-Ref 2 Nyquist</i></b>	Transfer function Nyquist for Reference 2
<b><i>FRF-Ref 3 Nyquist</i></b>	Transfer function Nyquist for Reference 3
<b><i>FRF-Ref 4 Nyquist</i></b>	Transfer function Nyquist for Reference 4
<b><i>Magnitude A / Magnitude B</i></b>	Spectrum Channel A / Spectrum Channel B

Spectral investigations can be carried out in this module. This module is suitable for the measurement of transfer functions which can then be evaluated in a modal analysis system.

The transfer functions [ $m/s^2/N$ ] as compliance function and the inverse FRF function [ $N/m$ ] as stiffness can be displayed simultaneously.



## FFT / Order analysis / Acoustics

The following tasks can be analysed in this module:

- FFT-Analysis
- Order analysis
- Acoustic Analysis
- Level measurements of structure-borne sound
- Level measurements of air-borne sound

<b>Zeitverlauf</b>	Signal Block with: 1024, 2048, 4096, 8192, 16384,32768,65536 Samples
<b>FFT-Spectrum</b>	FFT-Spectrum of a defined Signal Block
<b>Speed</b>	Speed vs time collected by the counter
<b>Order-Spectrum</b>	Order-Spectrum
<b>Ordnung-Amplitude vs. Speed</b>	Phase of a selected Order vs. Speed
<b>Ordnung-Amplitude vs. Time</b>	Amplitude of a selected Order vs. Time
<b>Ordnung-Phase vs. Speed</b>	Phase of a selected Order vs. Speed
<b>Ordnung-Phase vs. Time</b>	Phase of a selected Order vs. Time
<b>Order-Polar</b>	Polar Graph Magnitude/Phase of selected Orders
<b>Signal-Ringbuffer</b>	Collected Signal of the Ringbuffer
<b>Angular Resampling Signal</b>	Resampling Signal vs Rotating angle
<b>1X Amplitude vs. Speed</b>	1. Order Amplitude vs. Speed
<b>1X Amplitude vs. Time</b>	1. Order Amplitude vs. Time
<b>1X Phase vs. Speed</b>	1. Order Phase vs. Speed
<b>1X Phase vs. Time</b>	1. Order Phase vs. Time



<b>Time domain Level acc.</b>	Level $m/s^2$ vs. Time 125 ms 30 ms 1 s weighted
<b>Time domain Level vel.</b>	Level mm/s vs. Time 125 ms 30 ms 1 s weighted
<b>Time domain Level disp.</b>	Level $\mu m$ vs. Time 125 ms 30 ms 1 s weighted

<b>Time domain Speed</b>	Speed vs. Time
<b>Time domain 1X-Ampl. acc.</b>	1. Order $m/s^2$ Acceleration Level vs. Time
<b>Time domain 1X-Phase acc..</b>	1. Order $m/s^2$ Phase vs. Time
<b>Time domain 1X-Ampl. vel.</b>	1. Order mm/s Velocity Level vs. Time
<b>Time domain 1X-Phase vel.</b>	1. Order mm/s Phase vs. Time
<b>Time domain 1X-Ampl. disp.</b>	1. Order $\mu m$ Displacement Level vs. Time
<b>Time domain 1X-Phase disp.</b>	1. Order $\mu m$ Phase vs. Time
<b>Time domain RMS</b>	Root mean square vs. Time
<b>Time domain Mean-value</b>	Mean-value vs. Time
<b>Time domain Peak-Peak</b>	Peak-Peak vs. Time
<b>FFT-gemittelt</b>	FFT-Spectrum averaged
<b>Time domain Sound Level</b>	Sound Level Linear vs. Time dB
<b>Time domain Sound Level A-Filter</b>	Sound Level A-Weighted vs. Time dB A
<b>Time domain Sound Level C-Filter</b>	Sound Level C-Weighted vs. Time dB C
<b>Time domain Sound Power dB</b>	Sound-Power vs. Time dB
<b>Time domain Sound Power dBA</b>	Sound-Power vs. Time dB A
<b>Time domain Sound Power dBC</b>	Sound-Power vs. Time dB C
<b>Sound Power FFT</b>	FFT-Spectrum as Sound Power
<b>Sound Power dB vs. Speed</b>	Sound Power dB vs. Speed
<b>Sound Power dBA vs. Speed</b>	Sound Power dBA vs. Speed
<b>Sound pressure dB vs. Speed</b>	Sound Pressure dB vs. Speed



<b>Sound pressure dBA vs. Speed</b>	Sound Pressure dBA vs. Speed
<b>Sound Power dB vs. time</b>	Sound Power dB vs. Time
<b>Sound Power dBA vs. time</b>	Sound Power dBA vs. Time
<b>Sound pressure dB vs. time</b>	Sound Pressure dB vs. Time
<b>Sound pressure dBA vs. time</b>	Sound Pressure dBA vs. Time
<b>1/3 Octave-Spectrum</b>	1/3 Octave-Spectrum Lin / A / C Filter
<b>1/3 Octave-Sound Power</b>	1/3 Octave-Spectrum Sound-Power Lin / A / C Filter
<b>AVG. Sound pressure dB vs. Speed</b>	Sound Level (Average of all Microphones) dB vs. Speed
<b>AVG. Sound pressure dBA vs. Speed</b>	Sound Level (Average of all Microphones) dB A vs. Speed
<b>AVG. Sound pressure dB vs. time</b>	Sound Level (Average of all Microphones) dB vs. Time
<b>AVG. Sound pressure dBA vs. time</b>	Sound Level (Average of all Microphones) dB A vs. Time
<b>AVG. Sound pressure FFT</b>	FFT-Spectrum (Average of all Microphones)
<b>1/3 Octave-AVG. Sound press.</b>	1/3 Octave Spectrum (Average of all Microphones) Lin / A / C Filter
<b>1/3 Octave-T-AVG</b>	1/3 Octave Spectrum (Average over Time) Lin / A / C Filter
<b>1/3 Octave-Sound Power T-AVG</b>	1/3 Octave Spectrum Sound Power (Average over Time) Lin / A / C Filter
<b>FFT AVG. Sound pressure T-AVG</b>	FFT-Spectrum (Average of all Microphone average over Time)
<b>FFT Sound Power T-AVG</b>	FFT- Spectrum Sound Power (Average over Time) Lin / A / C Filter



## Balancing in two planes

The following tasks can be analysed in this module:

- FFT-analysis
- Order analysis
- Unbalance calculation

<b>Signal</b>	Signal Block with 1024, 2048, 4096, 8192, 16384, 32768, 65536 Samples
<b>FFT-Spectrum</b>	FFT-Spectrum of a defined Signal Block
<b>Speed</b>	Speed vs time collected by the counter
<b>Order-Spectrum</b>	Order-Spectrum
<b>Order-Amplitude vs. Speed</b>	Phase of a selected Order vs. Speed
<b>Order-Amplitude vs. Time</b>	Amplitude of a selected Order vs. Time
<b>Order-Phase vs. Time</b>	Phase of a selected Order vs. Speed
<b>Ordnung-Phase vs. Zeit</b>	Phase of a selected Order vs. Time
<b>Order-Polar</b>	Polar Graph Magnitude/Phase of selected Orders
<b>Signal Ringbuffer</b>	Collected Signal of the Ringbuffer
<b>Angular Resampling Signal</b>	Resampling Signal vs Rotating angle
<b>1X Amplitude vs. RPM</b>	1. Order Amplitude vs. Speed
<b>1X Amplitude vs. Time</b>	1. Order Amplitude vs. Time
<b>1X Phase vs. RPM</b>	1. Order Phase vs. Speed
<b>1X Phase vs. Time</b>	1. Order Phase vs. Time



Vibration Orderanalysis and Acoustics

### 5. Modul FFT / Order analysis / Acoustic

After selecting the measurement task, the Data Acquisition window is displayed.

**Ringbuffer** is the length of time for the amount of data to be held in RAM memory.

**Sample Rate** is the sampling frequency or values per second (48000 Hz).

**Recording-Time** is the length of time for data to be stored on the hard disk.

**Apply** all parameters are uploaded to the hardware

	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	CH 7	C
Status	ON	ON	ON	ON	ON	ON	OFF	O
Window	Hanning	Hanning	Hanning	Hanning	Hanning	Hanning	No window	N
Coupling	AC	AC	AC	AC	AC	AC	DC	D
Current Supply	ON	ON	ON	ON	ON	ON	OFF	O
Gain	1 V	10 V	1 V	1 V	1 V	1 V	10 mV	1
Channel-Text	Sensor 1							
High Pass								
Low Pass								
Offset	0,000	0,000	0,000	0,000	0,000	0,000	0,000	0,
Unit	Pa	Pa	Pa	Pa	Pa	Pa	V	V
mV / Unit	10	10	10	10	10	10	1000,00000	10
Unit / mV	0,10000	0,10000	0,10000	0,10000	0,10000	0,10000	0,00100	0,
Value of 0 dB	0,00002	0,00002	0,00002	0,00002	0,00002	0,00002	1,00000	1,



The settings for each measuring channel must be made here. For the speed, 3 signal types can be selected Pulse or periodic signal, Analogue (mV/RPM) or Frequency (mV/Hz). The Execute command accepts the settings and parameterises the hardware. The settings can be managed with Save and Load..

Filter:

**Filter on Ringbuffer** Sampling Frequency 12800,0 Hz

Type

Low pass  High pass  Bandpass pass  Notch

Frequency 100,0 Hz

Order

2 nd  4 th  6 th

Bandpass High and Low  Lower Frequency 0,0 Hz Upper Frequency 1000,0 Hz

**Active**

Apply to all Channels

Filters can be switched on here during data collection. The raw data are therefore filtered.



## 6. Analysis

- **FFT-Analysis** Block Size and Resolutio  
FFT waterfall is controlled by a counter.
- **Order analysis**  
Order resolution and number of orders  
Order waterfall with the counter
- **Speed control**  
Run up / run down
- **Level measurements Structure-borne sound**  
Total level Acceleration  
Speed Displacement
- **Level measurements Air-borne sound**  
A-weighting C-weighting Linear  
automatisch gestoppt werden.
- **Sound power**  
Microphone selection

Analysis\_Setup

**FFT-Analysis**

Sample-Rate 48000 Hz  
Bandwidth 19200 Hz  
FFT Block size 1601  
FFT-Resolution 11,719 Hz  
 Average Active Linear

**Orderanalysis**

Order Block size 128  
Order Resolution 1/8  
6,25 Order 8 Revolutions  
Average 0  
 Overlapping

Mathematical Channels

FFT-Waterfall counter

Orderanalysis-Waterfall counter

Order 1X Amplitude and Phase for Balancing counter

Overall Frequency band from 0,0 Hz to 22050,0 Hz

**Measurement condition for Waterfall** counter

Run-up  RPM Minimum 0 Diameter for Velocity km/h RPM ON

Run-down  RPM Maximum 8000 0 mm RPM OFF

Free Run  RPM Step 20

Time  Time Step (s) 0,00

Continuous time domain for Level

Continuous time domain for Level

Overall value [m/s^2]

Overall value [mm/s]

Overall value [µm]

Order 1X RMS [m/s^2] [mm/s] [µm] samples/revolution 16  
Revolution for Averaging 4

Peak-Peak-Value RMS-Value Mean-Value Period 0,100 s

Speed in time domain

Level Monitoring Time interval 5,0

Graph: No. of values per sec 100 Maximal Time span 600 s  
Maximum Buffer samples 200000

Continuous time domain for Acoustic Level

Continuous time domain for Acoustic Level

Overall Linear Filter

Overall A Filter

Overall C Filter

Surface 7,98 dB K1-Factor 0,00 dB K2-Factor 3,50 dB

Sound-Power : Level [dB] + Surface [dB] - K1 [dB] - K2 [dB]

Sound-Power max. 10 Microphones  Sound-Power-Waterfall counter

Stop Measurement after 10 s

Channel	Active
1	X
2	X
3	X
4	X
5	X
6	X

Setup Ringbuffer

Channels

Apply

Load

Save

Exit

For sound power, the measurement can be stopped automatically for the stationary case

The data is only active when Execute is displayed.

Example: Sound power with 10 microphones.



Level selection

→

**Continuous time domain for Acoustic Level**  
*Continuous time domain for Acoustic Level*

Overall Linear Filter  
 Overall A Filter  
 Overall C Filter

Sound-Power	
Channel	Active
1	X
2	X
3	X
4	X
5	X
6	X

Surface  dB    K1-Factor  dB    K2-Factor  dB

Sound-Power : Level [dB] + Surface [dB] - K1 [dB] - K2 [dB]

Sound-Power max. 10 Microphones   
  Sound-Power-Waterfall    counter

Stop Measurement after  s

In the table, the microphone channels must be activated with **X**. The following quantities must still be taken into account:

The surface, K1 ambient noise and K2 room correction are defined in dB.

With the activation **Sound Power Waterfall** the measuring points are recorded as a waterfall over speed or time.

For the stationary case there is the option to end the measurement automatically **End measurement after**.

After running, a new window appears for the channel assignment of the measurement tasks.

The memory space is limited and herewith each channel can take over a task.



	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	OFF 7	OFF 8	OFF 9	OFF 10	OFF 11	OFF 12	OFF 13	O
▶ Overall value [m/s <sup>2</sup> ]														
Overall value [mm/s]														
Overall value [μm]														
Order 1X RMS [m/s <sup>2</sup> ] [mm/s] [μm]														
Peak-Peak-Value RMS-Value Mean-Value														
Overall Linear Filter	X	X	X	X	X	X	X	X	X	X				
Overall A Filter	X	X	X	X	X	X	X	X	X	X				
Overall C Filter														

Ringbuffer : 200 s  
 Max. 833 s 220 MByte max. 18695 MByte

Size of Ringbuffer  s

Without this selection, no level calculation can be carried out.



## 7. Graphics setting

Setup

The screenshot shows the 'Display Physical functions' setup window. It is divided into several sections:

- Display Physical functions:** A table with columns for 'Diagr.', 'Function', 'Channel', 'Operator', and 'Filter'. The first row is selected, with 'Signal' in the Function column. A red arrow points to this row with a callout box labeled 'Select'.
- Multiple curves:** A section for adding multiple curves, with a 'Limit Curve' checkbox and a 'Limit Curve' button. A red arrow points to the 'Limit Curve' button with a callout box labeled 'Limit'.
- Display Settings:** A section with various options like 'Color / Borders / Fonts', 'Copy Settings of', 'X-Y-Type', 'Standard Scaling', 'Heat-map', and 'Put major files'. A red arrow points to the 'X-Y-Type' section with a callout box labeled 'Scaling of the X-axis and Y-axis'. Another red arrow points to the 'Standard Scaling' and 'Heat-map' buttons with a callout box labeled 'Set main graphic'.
- Buttons:** 'Apply', 'Load', 'Save', and 'Exit' buttons are visible at the bottom right. A red arrow points to the 'Exit' button with a callout box labeled 'FFT- Sonogram'.



### Display Settings

Color / Borders / Fonts

Font and color are defined here

**Color**

Graph

Frame

Curve

Grid

Label

Title

Cursor

Line width

Grid width

Cursor size

Border Frame

**Borders**

All Borders

Top

Bottom

Left

Right

**Polar-Display Position of 0°**

Vertical top

Horizontal left       Horizontal right

Vertical bottom

**Direction of Rotation**

Counter Clockwise

Clockwise

Apply      Diagr. 1

Font Top-Label      Font Legend      Font Y-Unit      Font X-Unit      Return

The fonts and colors are defined here .

The zero-degree position can also be defined for the polar display.



## Heat-map

Heatmap

**X-Axis**      **Y-Axis**

Frequency       Speed

Speed       Frequency

FFT-Spectra

Run Up      No. of Meas. 253

Run down

Free run

lin       dB

A-Filter       dBA

Channel 1

AVG. Sound pressure FFT

Order Lines

Order Min 1      Order Max 10      Delta Step 1

Scaling

X min 0 RPM

X max 6000

Y min 0 Hz

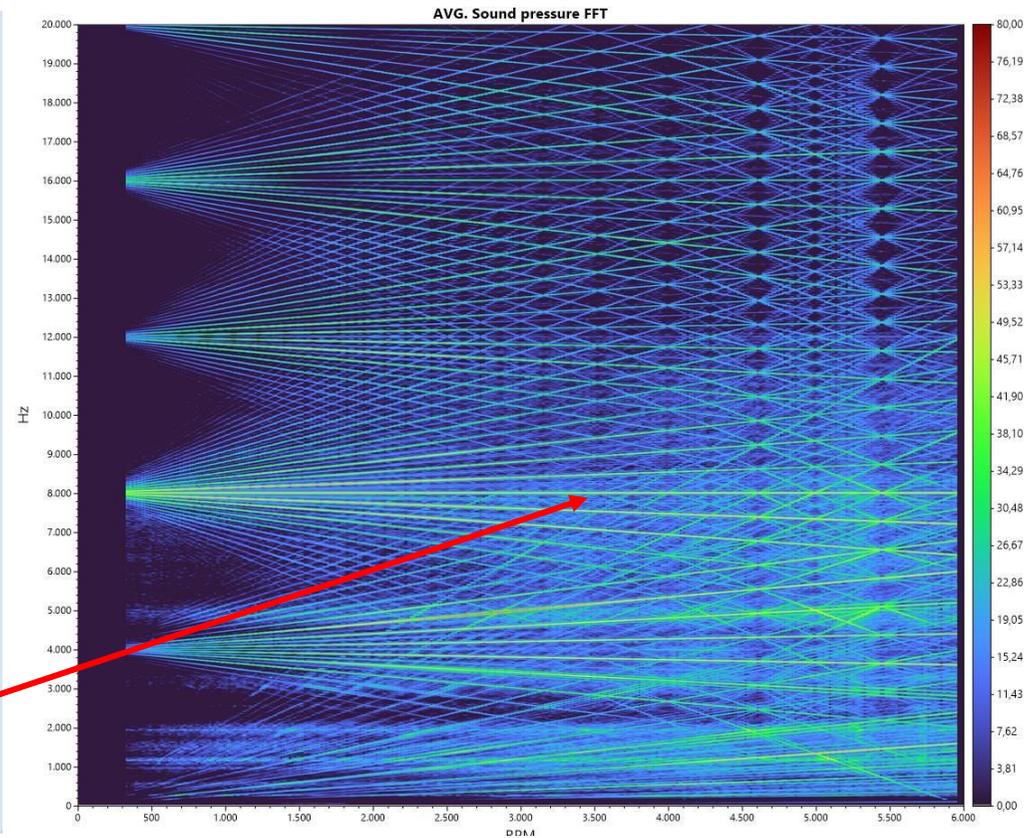
Y max 20000

Max Amplitude 80

Min Amplitude 0

Resolution Smooth

Build      Exit



After leaving the scaling and pressing Create, the sonogram appears



## Set main graphic

List of Display files

1	<input type="text" value="D:\Daten\Flachbahn\Grafik.GRP"/>	<input type="button" value="File"/>
2	<input type="text" value="D:\Daten\Flachbahn\Grafik 2.GRP"/>	<input type="button" value="File"/>
3	<input type="text"/>	<input type="button" value="File"/>
4	<input type="text"/>	<input type="button" value="File"/>
5	<input type="text"/>	<input type="button" value="File"/>
6	<input type="text"/>	<input type="button" value="File"/>
7	<input type="text"/>	<input type="button" value="File"/>
8	<input type="text"/>	<input type="button" value="File"/>
9	<input type="text"/>	<input type="button" value="File"/>
10	<input type="text"/>	<input type="button" value="File"/>

Here, individual diagrams can be displayed one after the other with DISP> and <DISP

Example setup for sound power



**Display Physical functions**

Diagr.	Function	Channel	Operator	Filter	Order
1	Norm - Order-Amplitude vs. Speed	1	direct	A	0,5000
2	Norm - Signal Ringbuffer	2			

**Multiple**

Channel: 1  
Curve: Add 2, Add 3, Add 4, Add 5  
 Limit  
Line width

Change and set to standard scaling

**Display Settings**

Velocity Axis km/h

Color / Borders / Fonts  
Change No of display

Copy Settings of  
 Color  
 Borders  
 Axis Scaling  
 Font Labels

Diagr. 1  
 Physical functions  
Copy settings to: All 1-9

Tabular-List  
Standard Scaling  
Heat-map  
Put major files

X-Y-Type  
X min: 0,00  
X max: 60,00  
Y min: -10,00  
Y max: 10,00  
 Lin  dB  
Grid:   
Grid delta:

**No. of Display**

1  
 2 x 1  
 1 x 2  
 3 x 1  
 1 x 3  
 4 x 1  
 2 x 2  
 3 x 2  
 2 x 3  
 4 x 2  
 2 x 4  
 3 x 3

3 Diagrams  
 4 Diagrams  
 4 Diagrams

Each setting in this screen must be confirmed with Apply.

With Number of diagrams, a graphic division can be selected

Example measurement: Sound power



The following settings are necessary in the analysis setup. If the speed channel is not available, RPM OFF must be set

- FFT- block size 6401 lines
- Delta f = 2,93 Hz
- Activation of
- In the table the microphones have to be activated
- Input of the surface in dB
- K1 Factor in dB and
- K2 Factor in dB

Analysis\_Setup

**FFT-Analysis**  
 Sample-Rate 48000 Hz  
 Bandwidth 19200 Hz  
 FFT Block size 1601  
 FFT-Resolution 11,719 Hz  
 Average Active Linear

**Orderanalysis**  
 Order Block size 128  
 Order Resolution 1/8  
 6,25 Order 8 Revolutions  
 Average 0  
 Overlapping

**Measurement condition for Waterfall** counter  
 Run-up  RPM Minimum 0 Diameter for Velocity km/h RPM ON   
 Run-down  RPM Maximum 8000 mm RPM OFF   
 Free Run  RPM Step 20  
 Time  Time Step (s) 0,10

Overall Frequency band from 0,0 Hz to 22050,0 Hz

**Continuous time domain for Level**  
 Continuous time domain for Level  
 Overall value [m/s<sup>2</sup>]  
 Overall value [mm/s]  
 Overall value [µm]  
 Order 1X RMS [m/s<sup>2</sup>] [mm/s] [µm] samples/revolution 16  
 Revolution for Averaging 4  
 Peak-Peak-Value RMS-Value Mean-Value Period 0,100 s  
 Speed in time domain  
 Level Monitoring Time interval 5,0 s

**Continuous time domain for Acoustic Level**  
 Continuous time domain for Acoustic Level  
 Overall Linear Filter  
 Overall A Filter  
 Overall C Filter

Channel	Active
1	X
2	X
3	X
4	X
5	X
6	X

Surface 7,98 dB K1-Factor 0,00 dB K2-Factor 3,50 dB

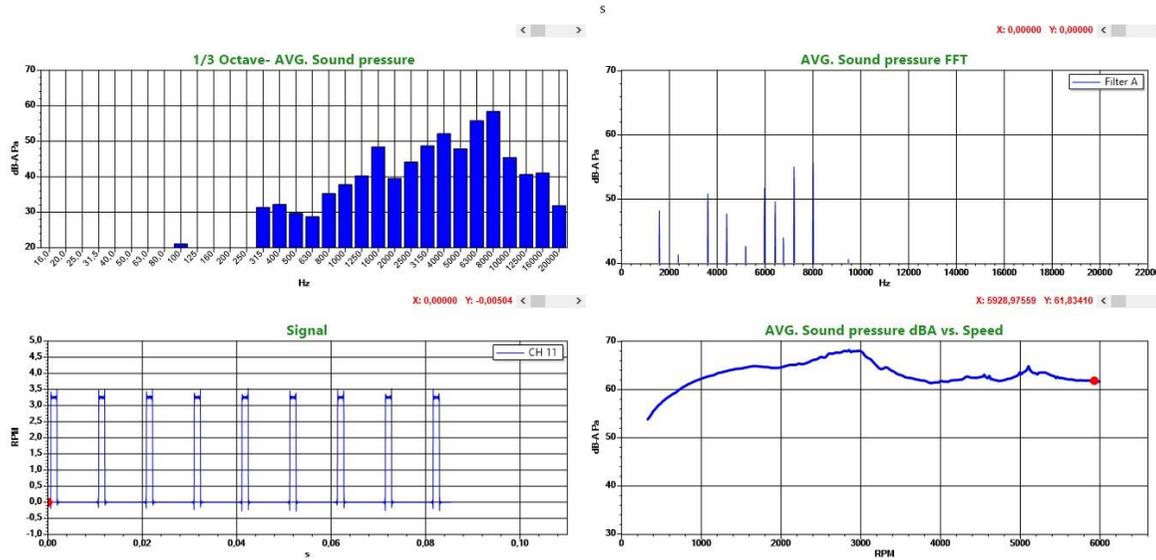
Sound-Power : Level [dB] + Surface [dB] - K1 [dB] - K2 [dB]

Sound-Power max. 10 Microphones  Sound-Power-Waterfall counter  
 Stop Measurement after 10 s

Graph: No. of values per sec 100 Maximal Time span 600 s  
 Maximum Buffer samples 200000

Buttons: Mathematical Channels, Setup Ringbuffer, Channels, Apply, Load, Save, Exit





Sound-Power =		Level [dBA] + Surface [dB] - K1 [dB] - K2 [dB]	
Surface	12,00 dB	K1-Factor	0,00 dB
		K2-Factor	0,00 dB
Channel 1	58,42 dB A	Channel 9	65,27 dB A
Channel 2	65,83 dB A		
Channel 3	61,63 dB A		
Channel 4	63,22 dB A		
Channel 5	55,31 dB A		
Channel 6	58,03 dB A		
Channel 7	59,66 dB A		
Channel 8	55,84 dB A		
Average-Level	61,83 dB A		
Sound-Power	73,83 dB A		

12 CH Measurement Period: 73,0 s Sampling rate: 48000 Hz

Measurement:  Freeze  Active **250 / 253**

Offline Recording: File length 73,0 s  Counter

Display: **5929 RPM**  Activate Cursor  Start  End

Change Display press: (Alt G)  Simple

Buttons: Setup, Sound, Load, Save, Display, < Disp, > Disp, Set, Print, Load, Setup, Analysis, Filter, Close, START



Sound-Power =	Level [dBA] + Surface [dB] - K1 [dB] - K2 [dB]				
Surface	12,00 dB	K1-Factor	0,00 dB	K2-Factor	0,00 dB
Channel 1		44,1 dB A	Channel 9		55,5 dB A
Channel 2		60,6 dB A			
Channel 3		55,9 dB A			
Channel 4		60,3 dB A			
Channel 5		48,0 dB A			
Channel 6		57,1 dB A			
Channel 7		57,9 dB A			
Channel 8		46,7 dB A			
Average-Level		56,7 dB A			AVG
Sound-Power		68,7 dB A			Copy

\\DATABASE\SI\_MOH\_SOUND\_POWER.ini

D:\SIEMENS\_MOH\Export\NNSABLONA\_training.xlsm

Name:

Average

Cursor position

Export to ASCII



## Calibration of the sensors

The screenshot shows the main software interface with several panels. On the left, there are buttons for 'Setup', 'Sound', 'Diagr. 1', 'Set', 'Load', 'Save', 'Curve 1', 'Print', 'Display', '< Disp', '1/10', 'Disp >', and '5994 RPM'. A red arrow points from the 'Setup' button to the 'Calibration' button in the next screenshot. In the center, there is an 'Offline Recording' panel with a dropdown menu set to '1', 'File length 73,0 s', and buttons for 'Load', 'Setup', 'Analysis', and 'Filter'. To the right, there are radio buttons for 'Start' (selected) and 'End', and a green 'START' button. On the far right, there is an 'Exit' button and technical specifications: '7458 Points Bandwidth 10750 Hz Res. Order Res. 1 / 8 Max Order 7,88'.

After selecting Setup, the following screen appears

The screenshot shows the 'Setup' menu with several options: 'Type of Measurement', 'Data Acquisition', 'Analysis', 'Calibration', 'Cursor', 'Scope', 'Acoustic Scope', and 'Back to Measurement'. The 'Calibration' button is highlighted with a red arrow pointing to it from the previous screenshot.

With the button Calibration the software changes to the calibration module.



## Sensor calibration

**Signal**

Pa

s

CH 1

**FFT-Spectrum**

Pa

Hz

CH 1

**Calibration-Type**

- 1 g RMS 159 Hz
- g RMS
- m/s<sup>2</sup> RMS
- Microphone 94 dB at 1000 Hz
- dB Microphone
- Microphone 114 dB at 1000 Hz
- Microphone 94 dB at 252 Hz

Setup Display

Average

Start

Exit

Select Channel to calibrate:  Pa

Calibration factor:  mV / Pa

Level:  dB

Structure-borne sound sensors

and microphones can be calibrated.

Number of averages

After selecting a calibration type, the measurement starts with START.

After calibration, the constants are taken over directly for the next measurement.



## Measurements Loading and Saving

12 CH Measurement Period: 73,0 s Sampling rate: 48000 Hz  
Measurement

Freeze

Setup Sound Diagr. 1 Set 253 / 253

Load Save Curve 1 Print

Display < Disp 1/10 Disp > 5994 RPM

Change Display press: (Alt G)  
 Simple

Offline Recording

1 File length 73,0 s  Counter

Load

Setup  Activate Cursor  Start  End

Analysis Filter

7458 Points Bandwidth 18750 Hz Res.  
Order Res. 1 / 8 Max Order 7.88

In this menu the following measurements can be loaded:

FFT-Spectrums

Order analysis data

1X first Order

Sound power data recalculated

Measurement Loads the active functions

Load Recording loads the raw data for  
for analysis.



**Load measurement**

Counter 0

FFT - Data

Order-Analysis Data

1X Order / Speed / Time

Calculate Soundpower / FFT-data





## Load Recording

The following data formats are supported:

- MDF-Format
- DAT-Format (The data format of the software)
- MP3-Format (Audio)
- WAV-Format (Audio)

The table describes the data content of this file. The speed channel can also be selected here. Number of pulses/revolution, trigger threshold and averaging are the inputs for the speed calculation

Setup Channels

ON No window V +X

Channel	ON/OFF	FFT-Window	0-dB Value	Factor	Offset	Unit	Point	Direction	Rot-X	Rot-Y	Rot-Z
1	ON	Hanning	0,000020	1,000000	0,000000	Pa	1	+Z	0,00	0,00	0,00
2	ON	Hanning	0,000020	1,000000	0,000000	Pa	2	+Z	0,00	0,00	0,00
3	ON	Hanning	0,000020	1,000000	0,000000	Pa	3	+Z	0,00	0,00	0,00
4	ON	Hanning	0,000020	1,000000	0,000000	Pa	4	+Z	0,00	0,00	0,00
5	ON	Hanning	0,000020	1,000000	0,000000	Pa	5	+Z	0,00	0,00	0,00
6	ON	Hanning	0,000020	1,000000	0,000000	Pa	6	+Z	0,00	0,00	0,00
7	ON	Hanning	0,000020	1,000000	0,000000	Pa	7	+Z	0,00	0,00	0,00
8	ON	Hanning	0,000020	1,000000	0,000000	Pa	8	+Z	0,00	0,00	0,00
9	ON	Hanning	0,000020	1,000000	0,000000	Pa	9	+Z	0,00	0,00	0,00
10	ON	Hanning	0,000020	1,000000	0,000000	Pa	10	+Z	0,00	0,00	0,00
11	ON	Hanning	1,000000	1,000000	0,000000	RPM	11	+Z	0,00	0,00	0,00
12	ON	Hanning	1,000000	1,000000	0,000000	V	12	+Z	0,00	0,00	0,00

Pulses
  Analog [RPM]
  Analog [Hz]

Channel: 12  RPM OFF

Trigger level: 1,000

Pulses / Rev: 1,000

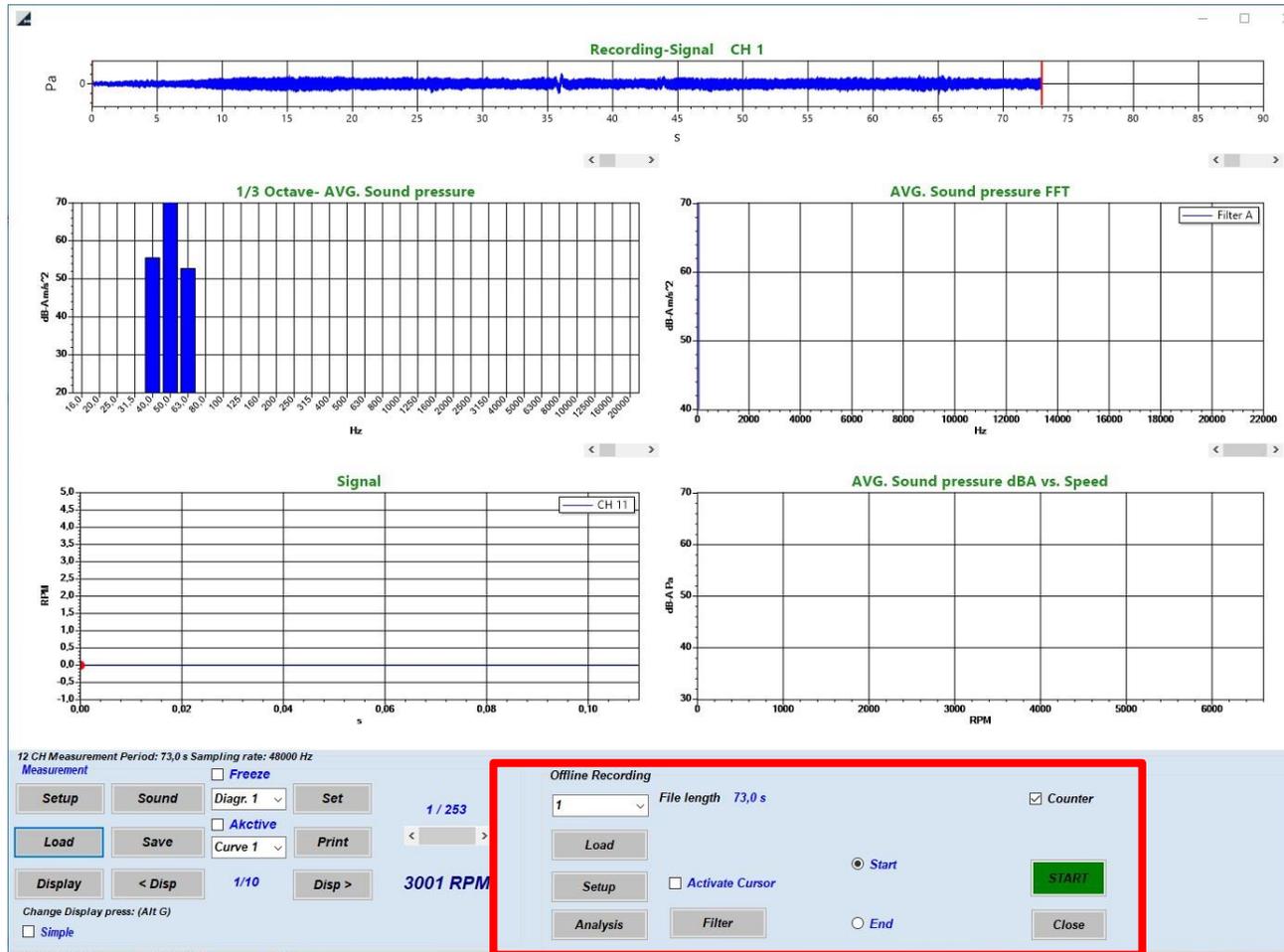
No of revolutions for Avg.: 1

Size of Ringbuffer: 200 s

Max. 466 s 439 MByte max. 7938 MByte

Import Header Export Header Continue

With Import/Export Header the table content is modified  
After the selection, the time course of the recording file is shown in the first diagram.





**Online Recording**

File length 73,0 s  Counter

1

Start  End

**Analysis\_Setup**

**FFT-Analysis**  
Sample-Rate 48000 Hz  
Bandwidth 19200 Hz  
FFT Block size 1601  
FFT-Resolution 11,719 Hz  
 Average Active Linear

**Orderanalysis**  
Order Block size 128  
Order Resolution 1/8  
6,25 Order 8 Revolutions  
Average 0  
 Overlapping

FFT-Waterfall counter  
 Orderanalysis-Waterfall counter  
 Order 1X Amplitude and Phase for Balancing counter  
Overall Frequency band from 0,0 Hz to 22050,0 Hz

**Measurement condition for Waterfall** counter  
Run-up  RPM Minimum 0 Diameter for Velocity km/h RPM ON   
Run-down  RPM Maximum 6500 mm RPM OFF   
Free Run  RPM Step 15  
Time  Time Step (s) 0,10

Continuous time domain for Level  
Continuous time domain for Level  
 Overall value [m/s<sup>2</sup>]  
 Overall value [mm/s]  
 Overall value [µm]  
 Order 1X RMS [m/s<sup>2</sup>] [mm/s] [µm] samples/revolution 16  
Revolution for Averaging 4  
 Peak-Peak-Value RMS-Value Mean-Value Period 0,100 s  
 Speed in time domain  
 Level Monitoring Time Interval 5,0 s

Graph: No. of values per sec 100 Maximal Time span 600 s  
Maximum Buffer samples 20000

Continuous time domain for Acoustic Level  
Continuous time domain for Acoustic Level  
 Overall Linear Filter  
 Overall A Filter  
 Overall C Filter

Channel	Active
1	X
2	X
3	X
4	X
5	X
6	

Surface 12,00 dB K1-Factor 0,00 dB K2-Factor 0,00 dB  
Sound-Power: Level [dB] + Surface [dB] - K1 [dB] - K2 [dB]  
 Sound-Power max. 10 Microphones  Sound-Power-Waterfall counter  
 Stop Measurement after 0 s

Load: Load new recording file

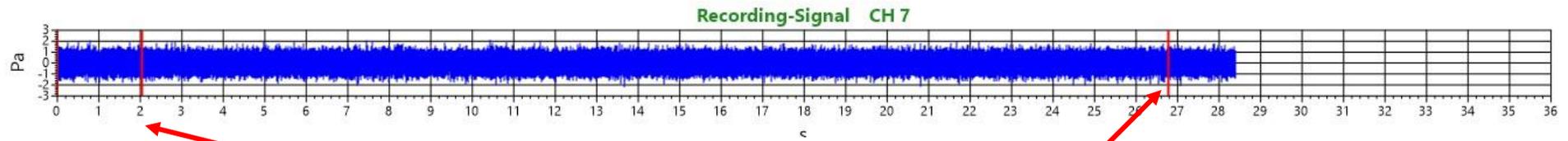
Setup: Table content of the recording file

Switch on cursor: The analysis area in the time course can be defined with this..

Analysis: Setting of the analysis.

With Start, the analysis begins as with online measurement.

Switch on the cursor: Start click and mark the position in the diagram with the mouse



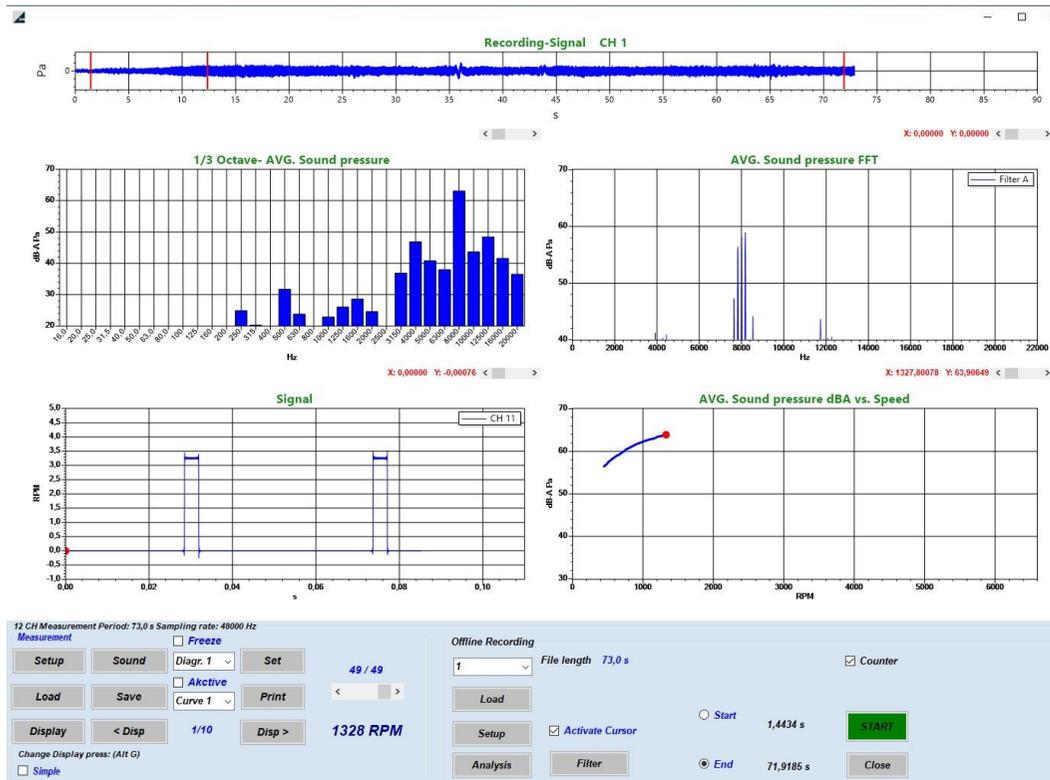
**Activate Cursor**

**Start**

**End**

Exit-Click is for the end position.

Start-Analysis



Sound-Power = Level [dBA] + Surface [dB] - K1 [dB] - K2 [dB]					
Surface	12,00 dB	K1-Factor	0,00 dB	K2-Factor	0,00 dB
Channel 1	59,83 dB A	Channel 9	67,59 dB A		
Channel 2	68,00 dB A				
Channel 3	65,91 dB A				
Channel 4	63,76 dB A				
Channel 5	56,39 dB A				
Channel 6	57,96 dB A				
Channel 7	61,96 dB A				
Channel 8	53,28 dB A				
Average-Level	63,91 dB A				
Sound-Power	75,91 dB A				



# Dual Plane Balancing

Balancing\_Form
✕

		CH	1X-MAG	1X-PHASE
Initial run	RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>
Testrun 1	RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>
Testrun 2	RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>
Balancing runs	1 RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>
	2 RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>
	3 RPM	1	<input type="text"/>	<input type="text"/>
		2	<input type="text"/>	<input type="text"/>

Rotor

Balancing setup

Open Balancing

Load

Save

Exit

RPM		Tacho	RPM
Balancing CH	1X-MAG	1X-PHASE	<input checked="" type="radio"/> Initial Run <input type="radio"/> Test run 1 <input type="radio"/> Test run 2 <input type="radio"/> Balancing run <span style="border: 1px solid gray; padding: 0 5px;">1</span>
1	2	2	
2	2	2	

Measure

Calculate Balancing

Initial

The dual plane balancing function is used to test and balance the rotor, data can be collected through several runs then the balancing runs commence to be as accurate as possible in balancing the rotor.



## Rotor Settings

Rotor

No. of Blancing Planes

Select Acquisiton Channels for Balancing

**Balancing Plane**

Balancing channel 1

Balancing channel 2

Balancing channel 3

Balancing channel 4

**Selected balancing Plane**  **Test run 1**  **Test mass**  **Position**

No. of Balancing positions

Start Angle

Radius of Test position

Radius of Balancing position

Angle

	POS	Deg	Test radius	Balancing radius	mass Test run 1	mass Test run 2
▶	1	15,00	15,00	15,00	0,00	0,00
	2	45,00	15,00	15,00	0,00	0,00
	3	75,00	15,00	15,00	0,00	0,00
	4	105,00	15,00	15,00	0,00	0,00
	5	135,00	15,00	15,00	0,00	0,00
	6	165,00	15,00	15,00	0,00	0,00
	7	195,00	15,00	15,00	0,00	0,00
	8	225,00	15,00	15,00	0,00	0,00
	9	255,00	15,00	15,00	0,00	0,00
	10	285,00	15,00	15,00	0,00	0,00

This tab is used to setup the software to the type of rotor that is going to be balanced (1 or 2 planes), number of balancing positions, the start angle and the radius of the test and balancing position. All settings can be loaded and saved for easy manipulation.

- **BUILD:** Create a balancing plane with the No. of Balancing positions and radius
- **ENTER:** Define a test mass with its position on the rotor
- **APPLY:** Apply the entered parameters
- **DISPLAY PLANES:** Show balancing planes
- **SAVE BALANCING PLANES:** Save settings
- **LOAD BALANCING PLANES:** Load previously saved setting
- **CLOSE:** Quit the settings page



## Plane Display

**Plane 1 Test Run 1**      **Plane 2 Test Run 1**      *Rotation Counter Clockwise*

**Plane 1 Test Run 2**      **Plane 2 Test Run 2**

Using the Display planes option the operator can virtually display the planes that are being balanced and customize the 0° position. You can use the mouse to click on a Plane to enlarge the diagram.

- **POSITION OF 0°:** Choose the 0° position on the rotor
- **CLOSE:** Quit page



## Rotor balancing method

Balancing\_Form

*Balancing method and Quality*

Remove test masses  
 Keep test masses

Weight of the rotor  kg  
Balancing speed  RPM  
Quality class  mm/s  
Residual imbalance  g mm

Exit



## Balancing results

The screenshot shows a software window titled "Balancing\_Form" with a close button (X) in the top right corner. The window content is titled "Balancing Results" and is divided into two sections: "Plane 1" and "Plane 2".

**Plane 1** section:

Imbalance	value 1	g mm	value 2	deg
Position	weight g		Angle deg	
A	<input type="text"/>		<input type="text"/>	
B	<input type="text"/>		<input type="text"/>	

**Plane 2** section:

Imbalance	value 1	g mm	value 2	deg
Position	weight g		Angle deg	
A	<input type="text"/>		<input type="text"/>	
B	<input type="text"/>		<input type="text"/>	

At the bottom of the window, there are two buttons: "Display Positions" (highlighted with a blue border) and "Exit".

Using this form the results can be displayed and analyzed.

- **DISPLAY POSITION:** This button will open a new tab to display more information about the run and the data that has been collected and the tests made.
- **EXIT:** Quit the open tab



# Rotor Balancing Results

Result\_EL\_BALANCING

Balancing Plane 1

**Balancing Result without removing initial masses**

POS	deg	Existing initial mass
1	15,00	
2	45,00	
3	75,00	
4	105,00	
5	135,00	
6	165,00	
7	195,00	
8	225,00	
9	255,00	
10	285,00	
11	315,00	
12	345,00	

**Balancing Result after removing initial masses**

POS	deg	Calculated mass [g]	Mounting mass [g]
1	15,00		
2	45,00		
3	75,00		
4	105,00		
5	135,00		
6	165,00		
7	195,00		
8	225,00		
9	255,00		
10	285,00		
11	315,00		
12	345,00		

**Prognosis**

Channel	Measurement	Prognosis
1	0,000 m/s <sup>2</sup> 0,0 deg	0,000 m/s <sup>2</sup> 0,0 deg
2	0,000 V 0,0 deg	0,000 V 0,0 deg

**Initial masses**

Plane 1 Rotation Counter Clockwise 270 deg

**Balancing Result without removing initial masses**

Plane 1 Rotation Counter Clockwise 270 deg

**Balancing Result after removing initial masses**

Plane 1 Rotation Counter Clockwise 270 deg

**Overview of mounted masses**

POS	deg	Bal. run 1 mass [g]	Bal. run 2 mass [g]	Bal. mas
1	15,00			
2	45,00			
3	75,00			
4	105,00			
5	135,00			
6	165,00			
7	195,00			
8	225,00			
9	255,00			
10	285,00			
11	315,00			
12	345,00			

**Imbalance 0,0000 [gmm] 180,0 deg**  
Balancing Result without removing initial masses  
 Remove mass  
 Add mass

**Imbalance 0,0000 [gmm] 180,0 deg**  
Balancing Result after removing initial masses  
 Remove mass  
 Add mass

Keep initial masses     Remove initial masses

Set masses    Bal. run 1    Remove masses  
 Load masses    Save masse  
 Delete table    Position of 0°    Close

Using this form the operator can balance the planes of the rotor by adding and removing weights in different areas, the results are displayed in real time and can be fine-tuned by the operator or technician at any time. All the results will be shown on the display diagrams and the table next to them.



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Last Updated: 2020.09.17

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