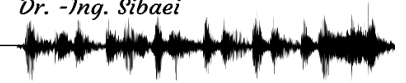


Balancing & Vibration Analysis

Instruction manual 2022



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

Selection of a measuring system

Balancing & Vibration Analysis

Supported Measurement devices

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

☐ LIT

☐ Office

English

Start

Exit

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

⇒ When they are purchased by the customer.

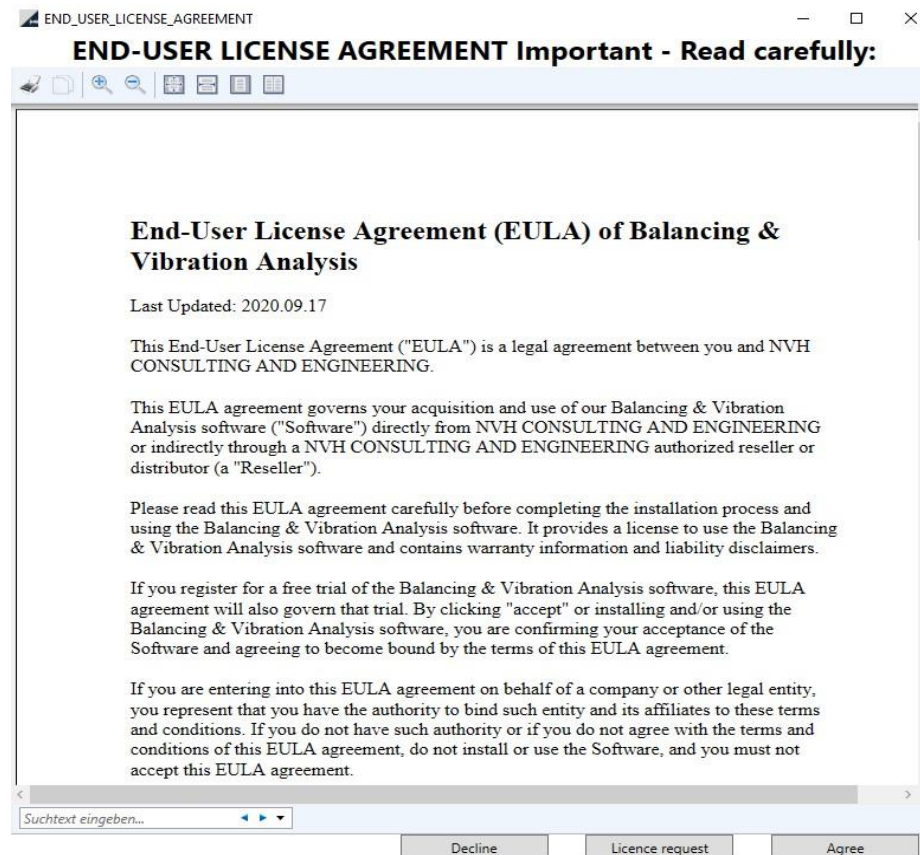
A measuring system must be selected on the start page. If Office is selected, the software works without a measuring device.

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.

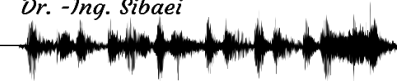


**When starting the software for the first time,
you must sign the END-USER LICENCE
AGREEMENT to use the programme.**

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.

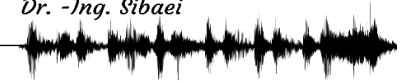


In order to get a License key, you have to send the Licence request file
to the following E-Mail-Adress:

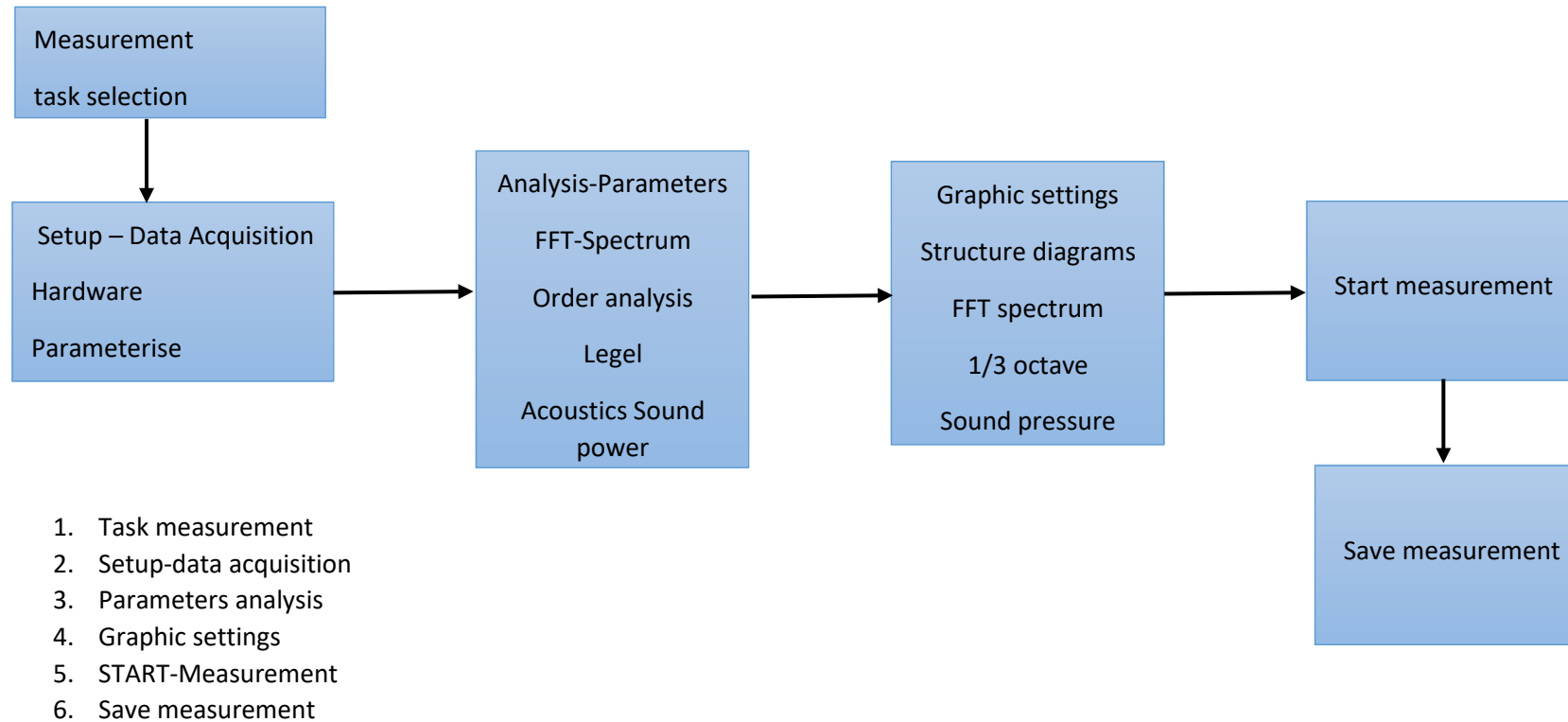
NVH-LicenceRequest.NVA

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



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.



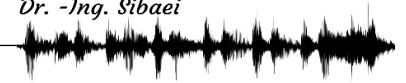
4. Measurement task

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

⇒ When they are purchased by the customer.

<i>FRF-Measurement</i>	<input type="radio"/>
<i>Vibration Orderanalysis and Acoustics</i>	<input checked="" type="radio"/>
<i>Monitoring Measurement</i>	<input type="radio"/>
<i>Dual Plane Balancing</i>	<input type="radio"/>
<i>Balancing Multiple plane</i>	<input type="radio"/>
<input type="button" value="Select"/>	

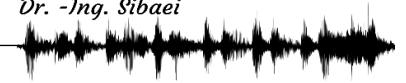
A measurement task is selected here.



4.1. Overview of the existing functions

FRF- Transfer functions

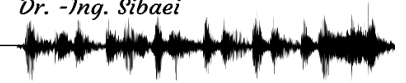
Signal	Triggered Signalblock with 1024, 2048, 4096, 8192, 16384,32768,65536 Samples
FFT-Spectrum	FFT-Spectrum of Signal-Block
FFT T-AVG	Averaged FFT-Spectrum
FRF-Ref 1 Mag	Transfer function Magnitude for Reference 1
FRF-Ref 1 Phase	Transfer function Phase for Reference 1
FRF-Ref 2 Mag	Transfer function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



FRF-Ref 3 Imag-part	Transfer function Imaginary-Part for Reference 3
FRF-Ref 4 Real-part	Transfer function Real-Part for Reference 4
FRF-Ref 4 Imag-part	Transfer function Imaginary-Part for Reference 4
FRF-Ref 1 Nyquist	Transfer function Nyquist for Reference 1
FRF-Ref 2 Nyquist	Transfer function Nyquist for Reference 2
FRF-Ref 3 Nyquist	Transfer function Nyquist for Reference 3
FRF-Ref 4 Nyquist	Transfer function Nyquist for Reference 4
Magnitude A / Magnitude 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 [$\text{m/s}^2/\text{N}$] 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:

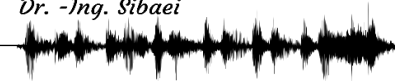
- FFT-Analysis
- Order analysis
- Acoustic Analysis
- Level measurements of structure-borne sound
- Level measurements of air-borne sound

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

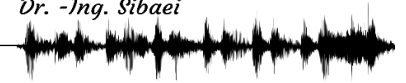


Time domain Level acc.	Level m/s^2 vs. Time 125 ms 30 ms 1 s weighted
Time domain Level vel.	Level mm/s vs. Time 125 ms 30 ms 1 s weighted
Time domain Level disp.	Level μm vs. Time 125 ms 30 ms 1 s weighted

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



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

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

Size of Ringbuffer: 200 s Max. 200 s Data Block size: 2048

Sample Rate: 48000 Hz

Maximal Recording time: 10 s

☐ Recording without FFT / Order

Channel Setup

Module: DIC24X

Channel Module: Ch 1

Channel: 1

Status: ON

Window: Hanning

Coupling: AC

Gain: 1 V

Current Supply: ON

Channel-Text: Sensor 1

Offset: 0,000

Unit: Pa

mV / Unit: 10

Unit / mV: 0,10000

Value for 0 dB: 0,00002

RPM: ☒ ON ☐ OFF

RPM-Setup

Signal-Type

A ☒ Pulses or Periodic signal

B ☐ Direct - Analog (mV / RPM)

C ☐ Direct - Analog (mV / Hz)

RPM Channel: 2

Pulses / Rev: 1,00

RPM Trigger: 1,00 V

Hold off μ s: 1

☐ 16 x Oversampling

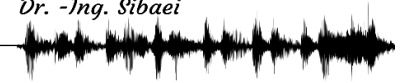
☐ Auto-Trigger

No of revolutions for Avg.: 1

from channel: 1 to channel: 6 Copy

	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	Sensor 1	Sensor 1	Sensor 1	Sensor 1	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	1000,0000	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,

Filter Save Load Exit Apply



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
 ×

Filter on Ringbuffer
Sampling Frequency 12800,0 Hz

Type

Low pass ☒
High pass ☐
Bandpass pass ☐
Notch ☐

Frequency Hz

Order

2 nd ☒
4 th ☐
6 th ☐

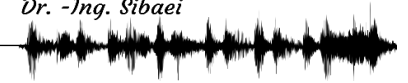
Bandpass High and Low ☐

Lower Frequency Hz
Upper Frequency 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

Measurement condition for Waterfall
Run-up ☐ RPM Minimum 0
Run-down ☐ RPM Maximum 8000
Free Run ☒ RPM Step 20
Time ☐ Time Step (s) 0,00
Diameter for Velocity km/h 0 mm
RPM ON ☒
RPM OFF ☐

Continuous time domain for Level
Continuous time domain for Level
Overall value [m/s²]
Overall value [mm/s]
Overall value [µm]
Order 1X RMS [m/s²] [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

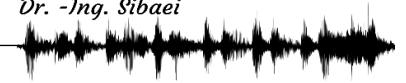
Continuous time domain for Acoustic Level
Continuous time domain for Acoustic Level
☒ Overall Linear Filter
☒ Overall A Filter
☐ Overall C Filter
Sound-Power
Channel Active
1 X
2 X
3 X
4 X
5 X
6 X
Surface 7,98 dB K1-Factor 0,00 dB K2-Factor 3,50 dB
Sound-Power : Level [dB] + Surface [dB] - K1 [dB] - K2 [dB]
☐ Sound-Power max. 10 Microphones
☐ Sound-Power-Waterfall counter
☐ Stop Measurement after 10 s

Buttons: 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

Sound-Power

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

☒ Overall Linear Filter
☒ Overall A Filter
☐ Overall C Filter

Surface dB

K1-Factor dB

K2-Factor dB

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

☐ Sound-Power max. 10 Microphones
☐ **Stop Measurement after** s

☐ Sound-Power-Waterfall counter

Setup Ringbuffer

Channels

Apply

Load

Save

Exit

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

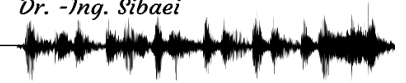
The surface, K1 ambient noise and K2 room correction are defined in dB.

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.



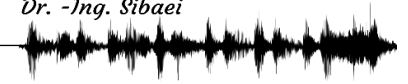
	CH 1	CH 2	CH 3	CH 4	CH 5	CH 6	OFF 7	OFF 8	OFF 9	OFF 10	OFF 11	OFF 12	OFF 13	OFF 14
Overall value [m/s ²]														
Overall value [mm/s]														
Overall value [μm]														
Order 1X RMS [m/s ²] [mm/s] [μm]														
Peak-Peak-Value RMS-Value Mean-Value														
Overall Linear Filter	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.



Human Vibration

FFT-Analysis
Sample-Rate 12800 Hz
Bandwidth 5000 Hz
FFT Block size: 6401
FFT-Resolution 0,781 Hz
☐ Average Active Linear

Orderanalysis
Order Block size: 256
Order Resolution: 1/2
50,00 Order 2 Revolutions
Average: 1
☐ Overlapping

☒ FFT-Waterfall
☐ Orderanalysis-Waterfall
☐ Order 1X Amplitude and Phase for Balancing
Overall Frequency band from 10,0 Hz to 1000,0 Hz

☒ Continuous time domain for Level
Continuous time domain for Level
☒ Human Vibration
☐ Overall value [m/s²]
☐ Overall value [mm/s]
☐ Overall value [µm]
☐ Order 1X RMS [m/s²] [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: 25 Maximal Time span: 300 s
Maximum Buffer samples 200000

Measurement condition for Waterfall
Run-up: ☒ RPM Minimum: 600 Diameter for Velocity km/h: 0
Run-down: ☐ RPM Maximum: 10001 mm
Free Run: ☐ RPM Stop: 10
Time: ☐ Time Stop (s): 0,00 ☐ Low pass 1,2 x Max speed

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

Channel	Active
1	
2	
3	
4	
5	
6	

Surface: 0,00 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 0 s

Mathematical Channels
Setup Ringbuffer
Human Setup
Channels
Apply
Load
Save
Exit

☒ Triax 1 Channel
X-Axis: 1
Y-Axis: 2
Z-Axis: 3
☒ Hand-Arm
☐ Whole-Body Standing Sitting
☐ Whole-Body lying
No of measurements: 5
No of Users: 3

☒ Triax 2 Channel
X-Axis: 4
Y-Axis: 5
Z-Axis: 6
☒ Hand-Arm
☐ Whole-Body Standing Sitting
☐ Whole-Body lying
OK



7. Graphics setting

Setup

Display Physical functions

Diagr.	Norm	Function	Channel	Operator	Filter
1	<input checked="" type="checkbox"/>	Signal	1	direct	Lin
2	<input type="checkbox"/>	FFT-Spectrum	1	direct	Lin

Multiple curves

Channel	Curve	Active	Color
1			
Add 2	<input type="checkbox"/>		
Add 3	<input type="checkbox"/>		
Add 4	<input type="checkbox"/>		
Add 5	<input type="checkbox"/>		
<input type="checkbox"/> Limit Curve			

Line width: 1

☒ Change and set to standard scaling

Display Settings

Color / Borders / Fonts

Change No of display

Copy Settings of

☐ Color
☐ Borders
☐ Axis Scaling
☐ Font Labels

Diagr. 1

☐ Physical functions

All 1-9

☐ Tabular-List

☐ Y-Auto-scale

Diagr. 1

X-Y-Type

X min: 0,00

X max: 0,32

dX: 0,06

Y min: -5,00

Y max: 5,00

dY: 2,50

☒ Lin
☐ dB
☒ Grid
☒ Grid delta

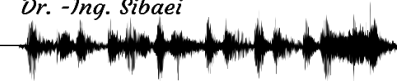
Select

Limit

Scaling of the X-axis and Y-axis

Set main graphic

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

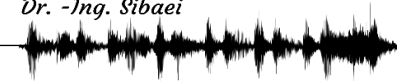
Font Y-Unit

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

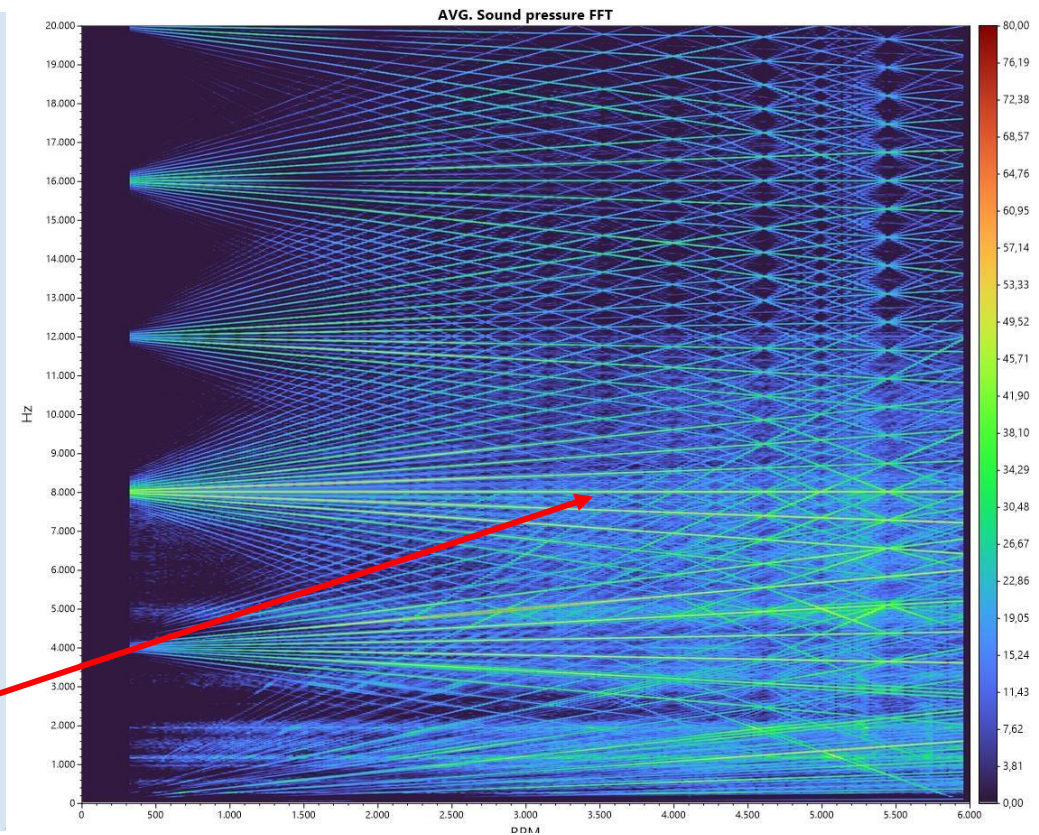
Y max 20000

Max Amplitude 80

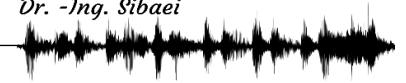
Min Amplitude 0

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
2	Norm	Signal Ringbuffer	2		0,5000

Multiple

Channel

1

Curve

Add 2

Add 3

Add 4

Add 5

Limit

Line wi

☐ Change and set to standard scaling

Display Settings

Color / Borders /Fonts

Change No of display

☐ Velocity Axis km/h

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

X-Y-Type

X min

0,00

X max

60,00

Y min

-10,00

Y max

10,00

Lin

dB

Grid

☒

Grid delta

☒

Put major files

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

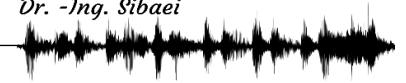
4 Diagrams

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
 Run-up ☐ RPM Minimum 0
 Run-down ☐ RPM Maximum 8000
 Free Run ☒ RPM Step 20
 Time ☐ Time Step (s) 0,10
 Diameter for Velocity km/h 0 mm
 RPM ON ☒
 RPM OFF ☐

Continuous time domain for Level
☐ Overall value [m/s²]
☐ Overall value [mm/s]
☐ Overall value [μm]
☐ Order 1X RMS [m/s²] [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
☒ 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
☐ Stop Measurement after 10 s

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

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



☒ **Continuous time domain for Level**
Continuous time domain for Level

☐ Overall value [m/s²]
☐ Overall value [mm/s]
☐ Overall value [µm]
☐ Order 1X RMS [m/s²] [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

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

Sound-Power

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

Setup Ringbuffer

Channels

Apply

Load

Save

Exit

Overall Frequency band / Averaging time

0,0

Hz

☐ Frequency band

Low pass

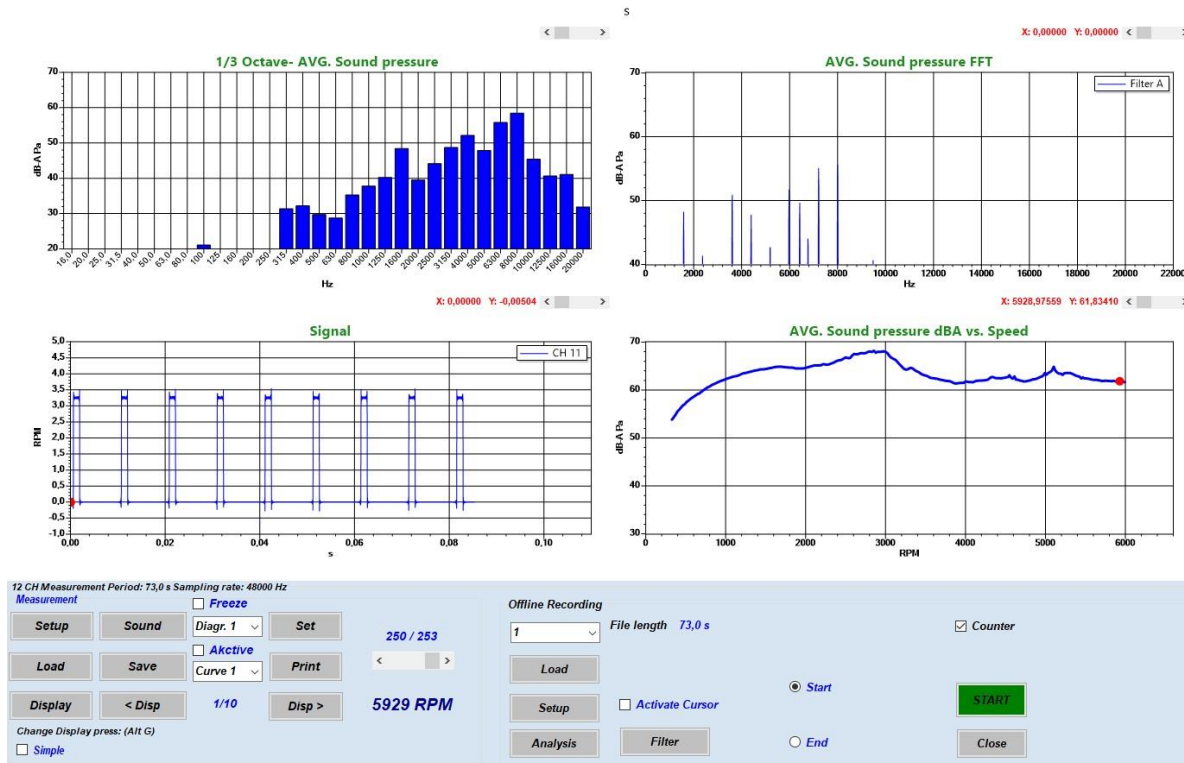
12800,0

Hz

☒ Fast 125 ms
☐ Slow 1 s
☐ Impact 30 ms
☐ 10 ms

Fast Slow or Impulse evaluations can be selected for the level calculation.

Pressing the Start button starts the measurement.



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		



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

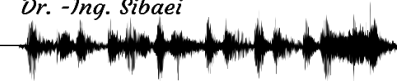
D:\\SIEMENS_MOH\\Export\\NNSABLONA_training.xlsx

Name:

☒ Average

☐ Cursor position

Export to ASCII



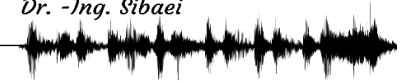
Calibration of the sensors



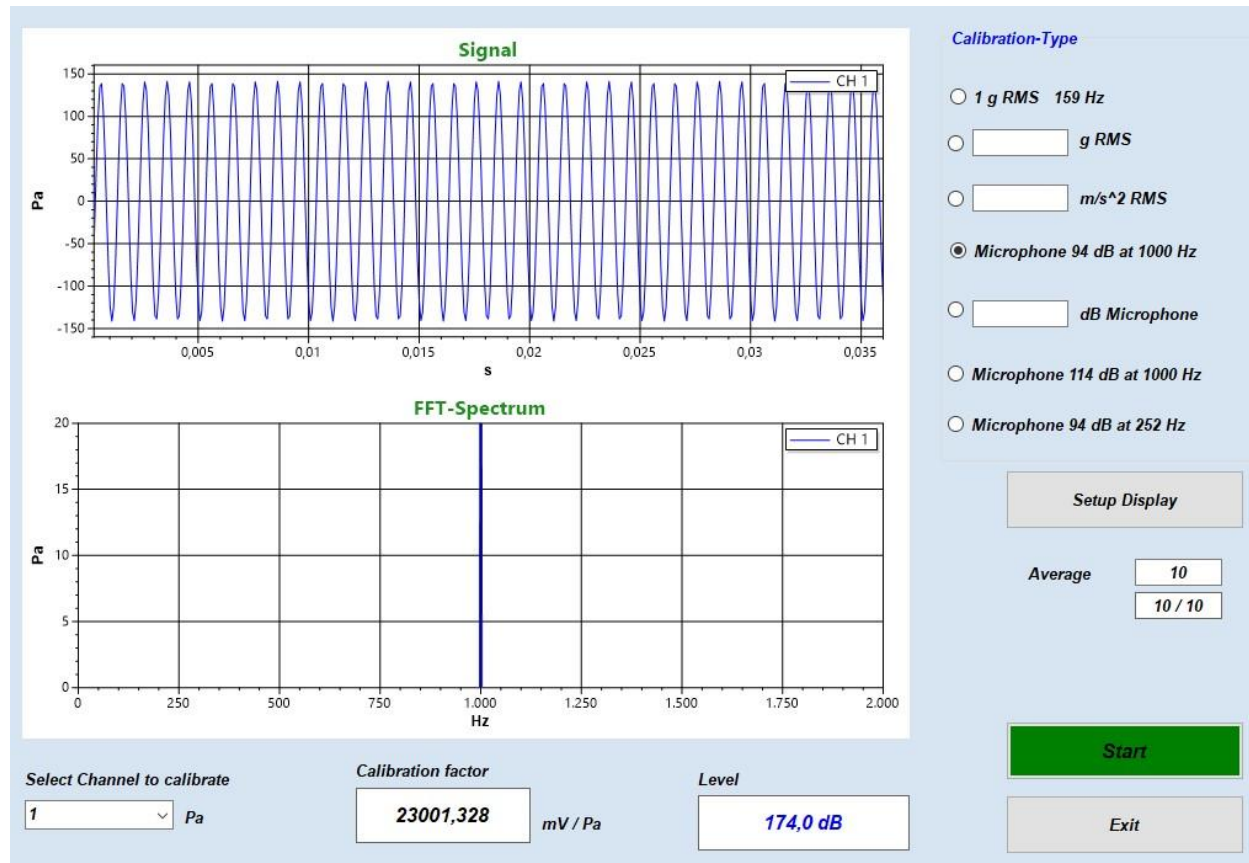
After selecting Setup, the following screen appears



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



Sensor calibration



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

Analysis Filter

☒ Start

☐ End

START

Close

Exit

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

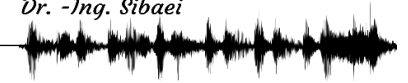
☐ FFT - Data

☐ Order-Analysis Data

☐ 1X Order / Speed / Time

☐ Calculate Soundpower / FFT-data

Load measurement Load Recording



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	0,00000	Pa	1	+Z	0,00	0,00	0,00
2	ON	Hanning	0,000020	1,000000	0,00000	Pa	2	+Z	0,00	0,00	0,00
3	ON	Hanning	0,000020	1,000000	0,00000	Pa	3	+Z	0,00	0,00	0,00
4	ON	Hanning	0,000020	1,000000	0,00000	Pa	4	+Z	0,00	0,00	0,00
5	ON	Hanning	0,000020	1,000000	0,00000	Pa	5	+Z	0,00	0,00	0,00
6	ON	Hanning	0,000020	1,000000	0,00000	Pa	6	+Z	0,00	0,00	0,00
7	ON	Hanning	0,000020	1,000000	0,00000	Pa	7	+Z	0,00	0,00	0,00
8	ON	Hanning	0,000020	1,000000	0,00000	Pa	8	+Z	0,00	0,00	0,00
9	ON	Hanning	0,000020	1,000000	0,00000	Pa	9	+Z	0,00	0,00	0,00
10	ON	Hanning	0,000020	1,000000	0,00000	Pa	10	+Z	0,00	0,00	0,00
11	ON	Hanning	1,000000	1,000000	0,00000	RPM	11	+Z	0,00	0,00	0,00
12	ON	Hanning	1,000000	1,000000	0,00000	V	12	+Z	0,00	0,00	0,00

Configuration Panel:

☒ Pulses ☐ Analog [RPM] ☐ Analog [Hz]

Channel: 12 ☐ RPM OFF

Trigger level: 1,000

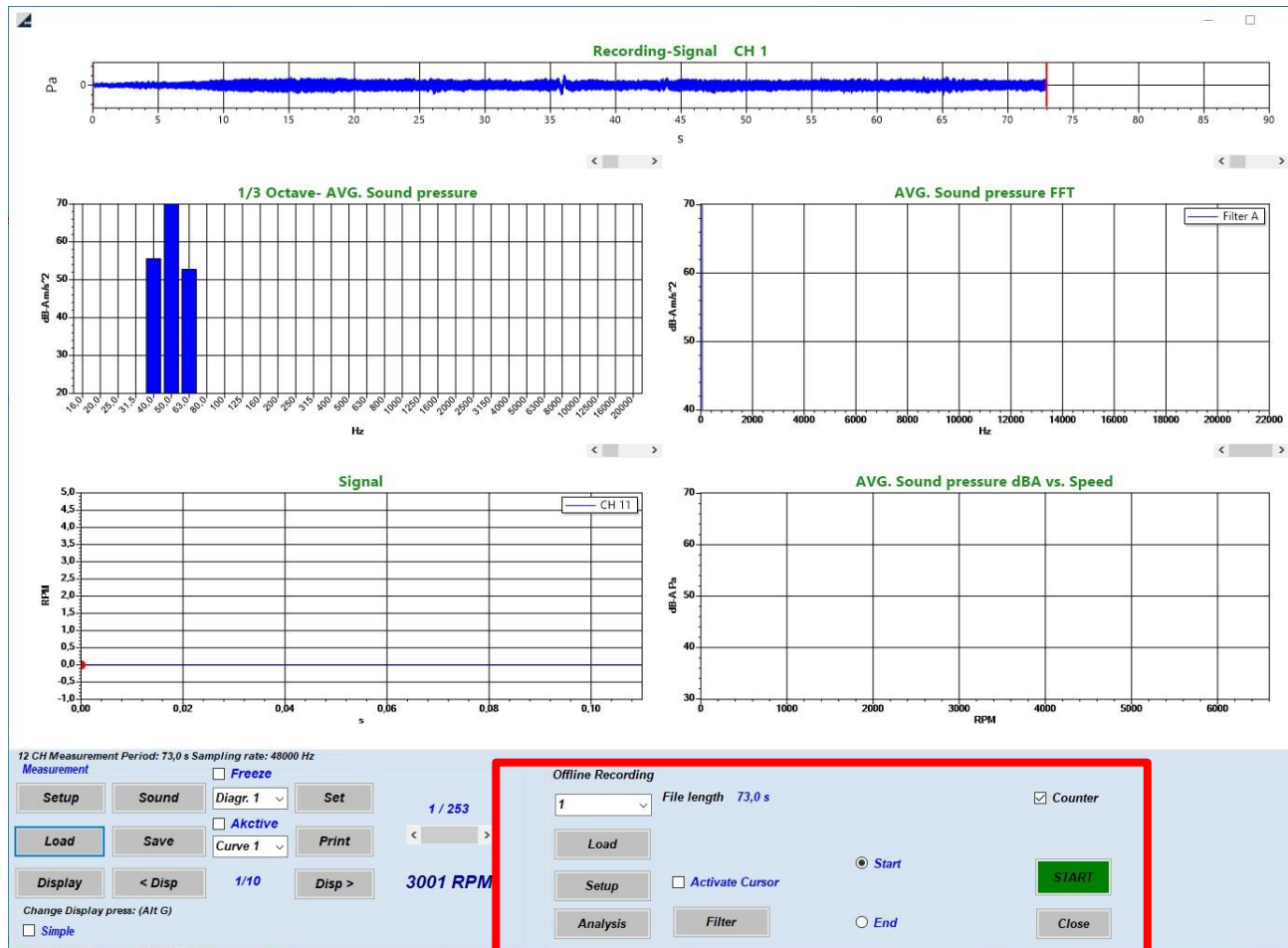
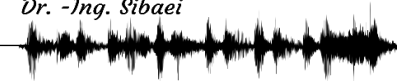
Pulses / Rev: 1,000

No of revolutions for Avg.: 1

Size of Ringbuffer
Max. 466 s 439 MByte max. 7938 MByte

200 s

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.





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.

Online Recording

File length 73,0 s ☒ Counter

1

☒ Start ☐ End

☐ Activate Cursor

Analysis_Setup

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

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

☒ 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
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^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 s

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

Sound-Power

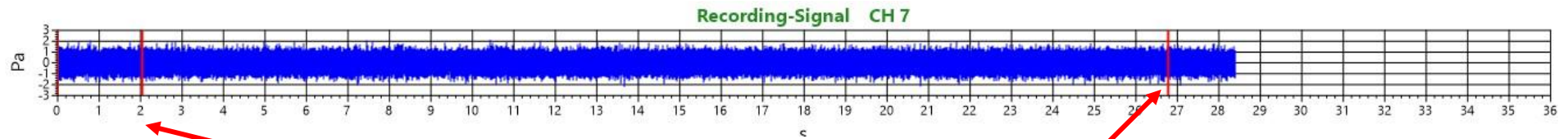
Channel	Active
1	X
2	X
3	X
4	X
5	X
6	X

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

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



☒ **Activate Cursor**

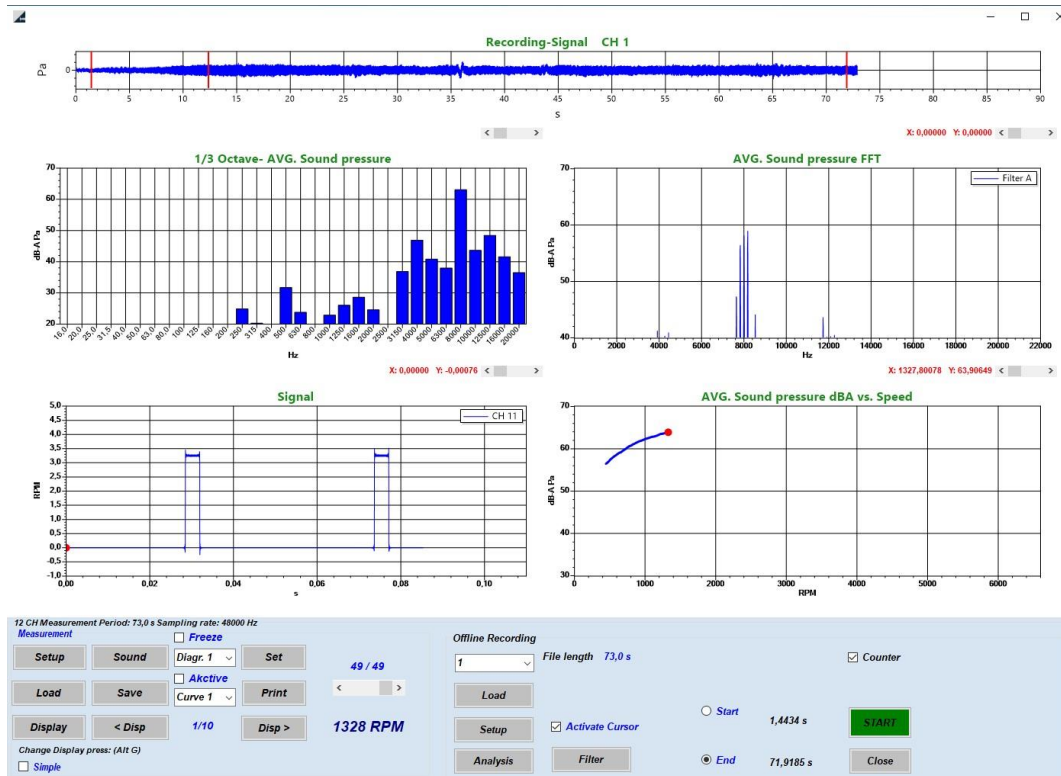
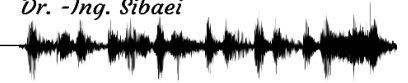
☐ **Start**

☐ **End**

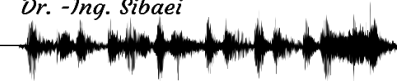
Filter

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"/>

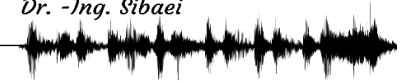
Rotor

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
1	2	2	1
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 Balancing Planes

Select Acquisition Channels for Balancing

Balancing Plane

☒ Balancing channel 1

☒ Balancing channel 2

☐ Balancing channel 3

☐ Balancing channel 4

No. of Balancing positions

Start Angle

Radius of Test position

Radius of Balancing position

Angle

Selected balancing Plane Test run 1

Test mass Position

	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

Build

Enter

Apply

Display Planes

Save Balancing Planes

Load Balancing Planes

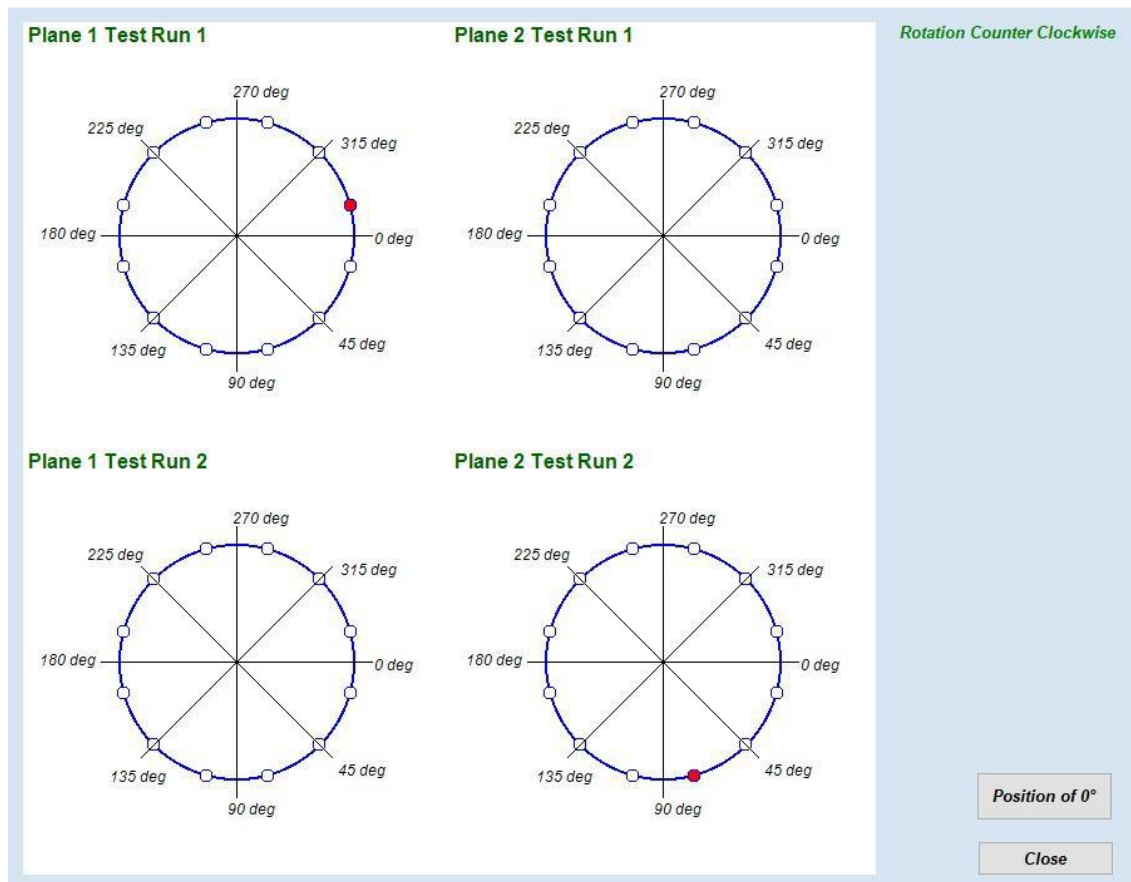
Close

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

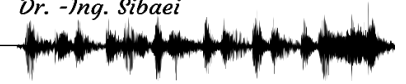


Plane Display



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

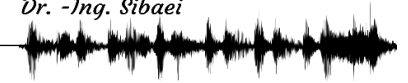
Weight of the rotor kg

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. The main content area is titled "Balancing Results" and contains two sections for "Plane 1" and "Plane 2". Each section has a header row with "Imbalance", "value 1", "g mm", "value 2", and "deg". Below each header is a table with two columns: "Position" and "weight g". Under "Position", there are two rows labeled "A" and "B". Each row has a text input field for "weight g" and a text input field for "Angle deg". At the bottom of the window, there are two buttons: "Display Positions" and "Exit".

Plane 1				
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				
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"/>		

Display Positions 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

Balancing Result after 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	

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		

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^2 0,0 deg	0,000 m/s^2 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.

End-User License Agreement (EULA) of Balancing & Vibration Analysis

Last Updated: 2020.09.17

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This EULA agreement governs your acquisition and use of our Balancing & Vibration Analysis software ("Software") directly from NVH CONSULTING AND ENGINEERING or indirectly through a NVH CONSULTING AND ENGINEERING authorized reseller or distributor (a "Reseller").

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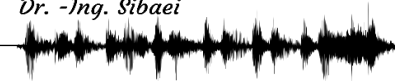
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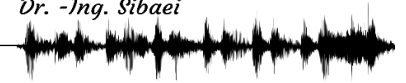
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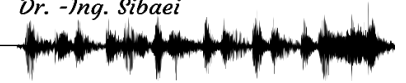


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