

Balancing & Vibration Analysis

Documentation

SIBAEI ENGINEERING

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

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A word from the engineers

Thank you for purchasing our software. This software was designed by engineers for engineers and portability and simplicity were the key features in our development strategy, so it can run on any type of hardware (low- or high-end machines).

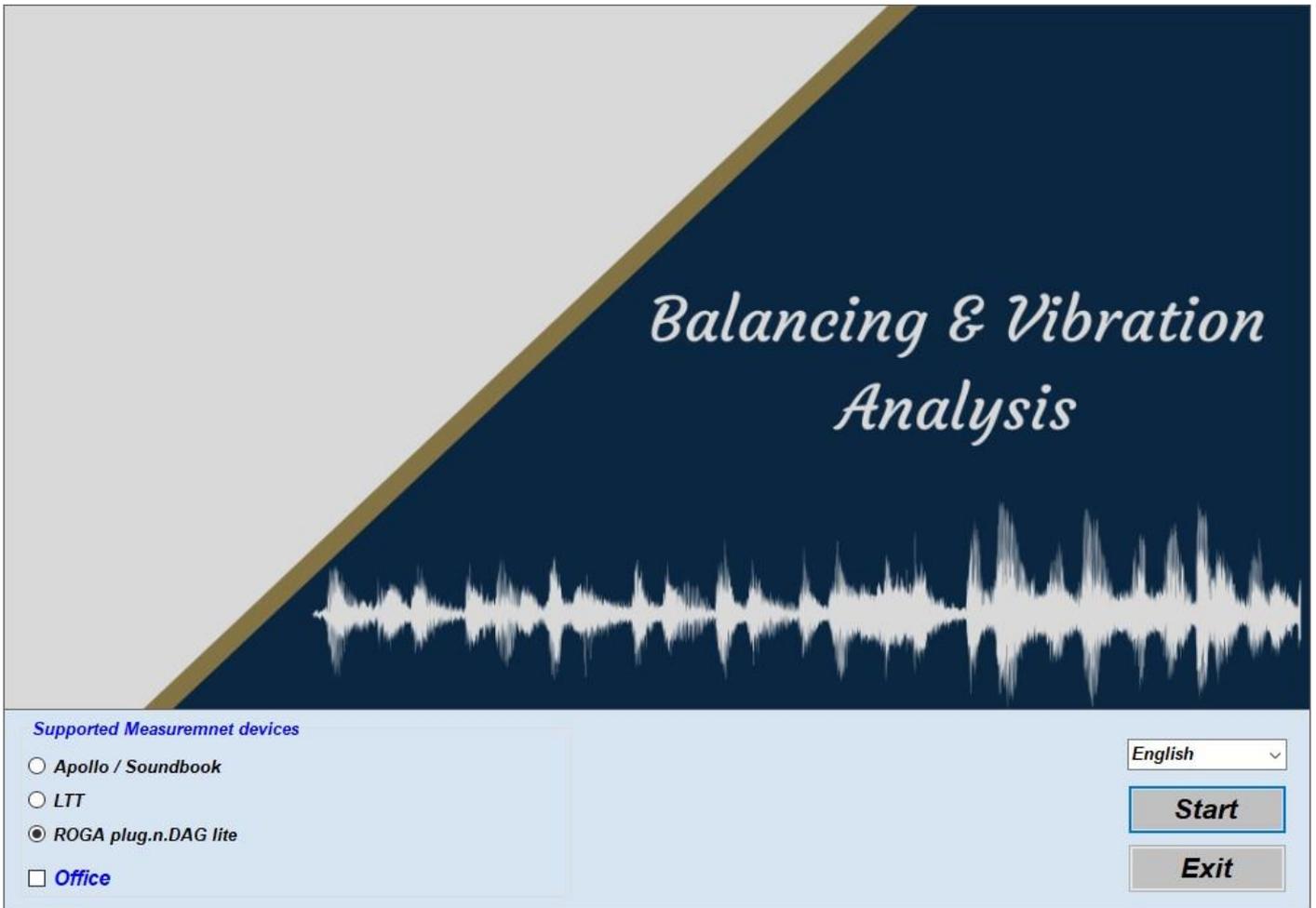
This software will help you with all your vibration analysis needs whether the data is captured live using one of our partners tools or prerecorded data.

For any information do not hesitate to contact us we will be glad to help you.

E-mail: info@sibaei-engineering.de

Website: www.sibaei-engineering.de

Welcome Screen



This is the first screen you see when the software is launched.

Here can be chosen:

- The language for the software
- The type of instrument that is being used to record the data
- **OFFICE:** Pre-recorded data (for analysis)
- **EXIT:** Quit the software
- **START:** Start the software in the chosen mode

Sound_Device

Device

Apply *END*

Here the operator can choose the device that is going to be used to capture the data to be analyzed.

- **APPLY:** Confirm selection
- **END:** Exit the software

Type of Measurement Screen

FRF-Measurement

Vibration Orderanalysis and Acoustics

Dual Plane Balancing

Monitoring Measurement

Select

On this screen you can choose the type of measurement that needs to be performed.

The screenshot shows a software window titled "Sound_Card_HW" with the following settings:

- Size of Ringbuffer:** 100 s
- Maximal Recording time:** 10 s
- Sample Rate:** 48000 Hz
- Sound-device:** 0
- Channel Range:** 5,0 Volt
- RPM:** ON (radio button selected)

Channel-specific settings for Channel 1 and Channel 2:

	Channel 1	Channel 2
Status	ON	ON
Window	No window	No window
Offset	0,000	0,000
Unit	Pa	Pa
mV / Unit	10,00000	10,00000
Unit / mV	0,10000	0,10000
Value for 0 dB	0,00002	0,00002
Channel-Text	CH 1	CH 2

RPM-Setup section:

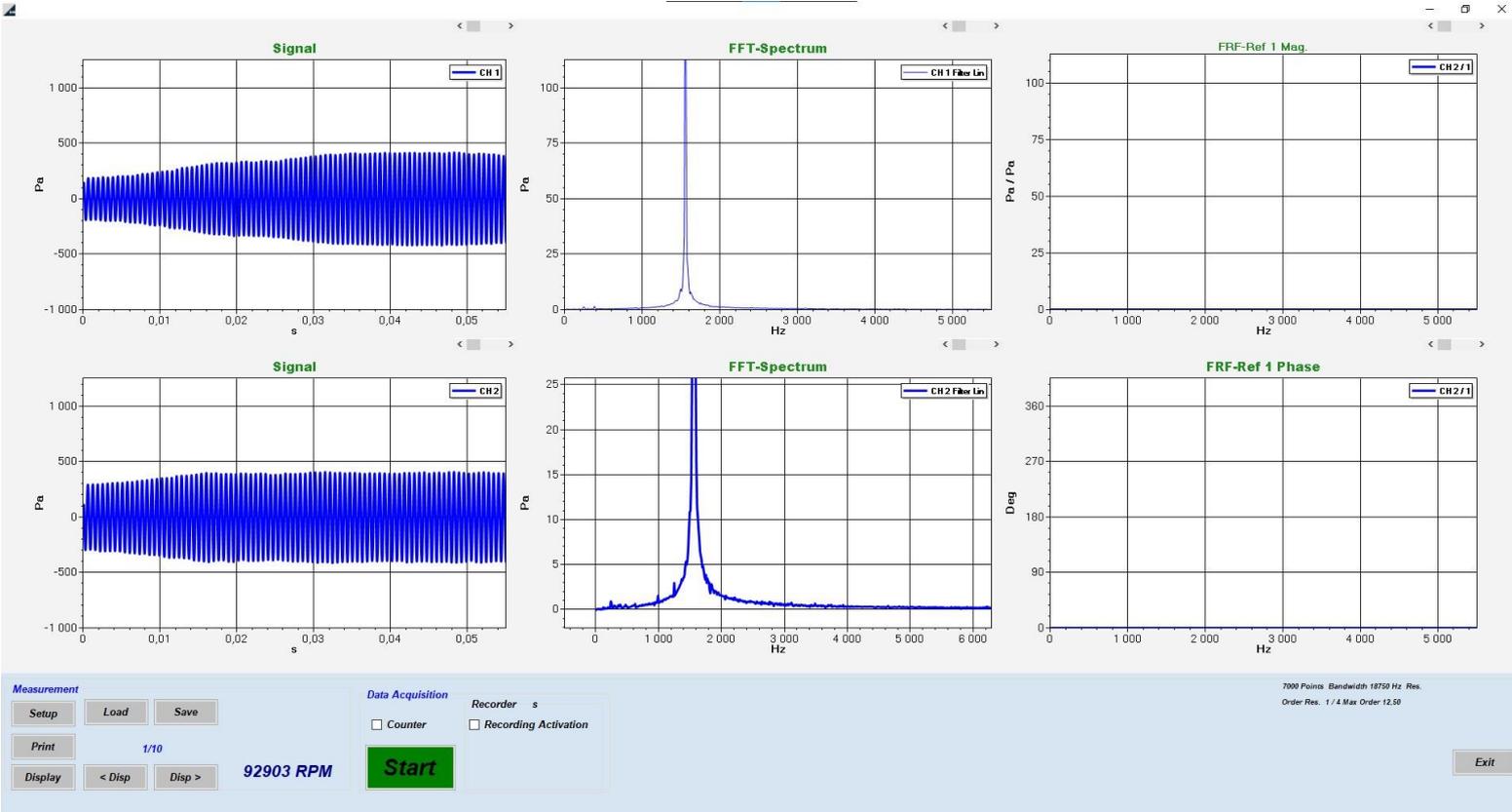
- RPM Channel:** 2
- Pulses / Rev:** 1,00
- RPM Trigger level (Volt):** 1,00
- No of revolutions for Avg.:** 1
- Auto-Trigger:**

Buttons at the bottom: Apply, Save, Load, Exit.

This form is used to set the parameters for the data acquisition.

- **APPLY:** Apply the settings
- **SAVE:** Save the chosen settings for future use in a file
- **LOAD:** Load saved settings from a file
- **EXIT:** Exit the software

Main Screen



This is the main screen all of the chosen data will be displayed here and can be customized to fit all your needs. (what type of data to be shown and the way it is displayed).

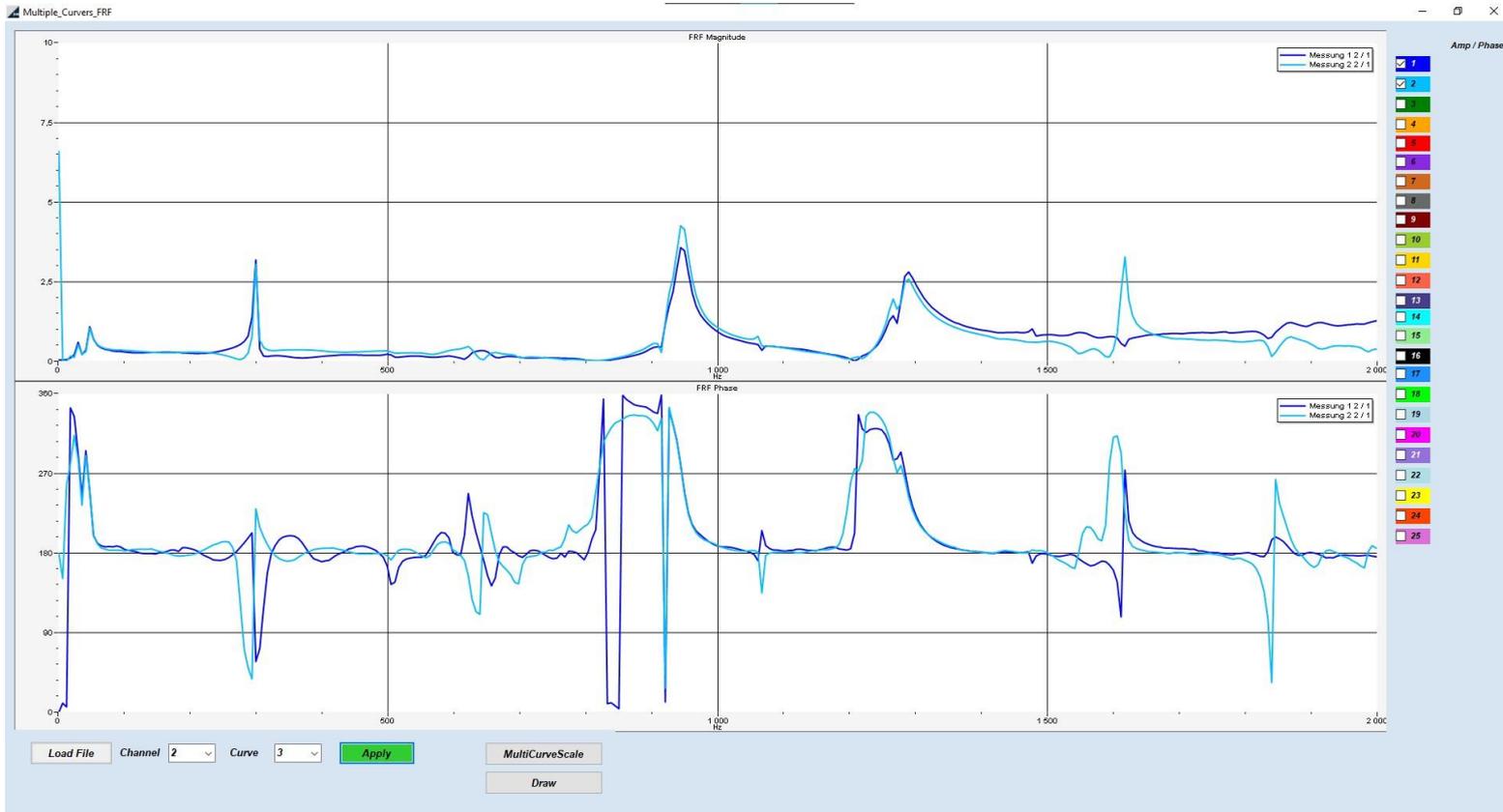
- **SETUP:** Configure the software and the data to be shown
- **PRINT:** Print (or print to PDF) the data collected (shown on the active screen)
- **LOAD:** Load saved data and configuration
- **SAVE:** Save data and configuration
- **< DISP:** Change active display in descending order (major files)
- **> DISP:** Change active display in ascending order (major files)
- **RECORDER:** Record the data to a file during acquisition
- **START:** Begin the data acquisition if live data or start the recorded data in office mode
- **EXIT:** Quit the software

Multiple measurement analysis (Offline)



By clicking on the load button on the main window the user can use the compare function for the FRF-Spectra or FRF-Spectra Modal to compare several curves and measurement points.

FRF-Spectra analysis



Channel
Curve

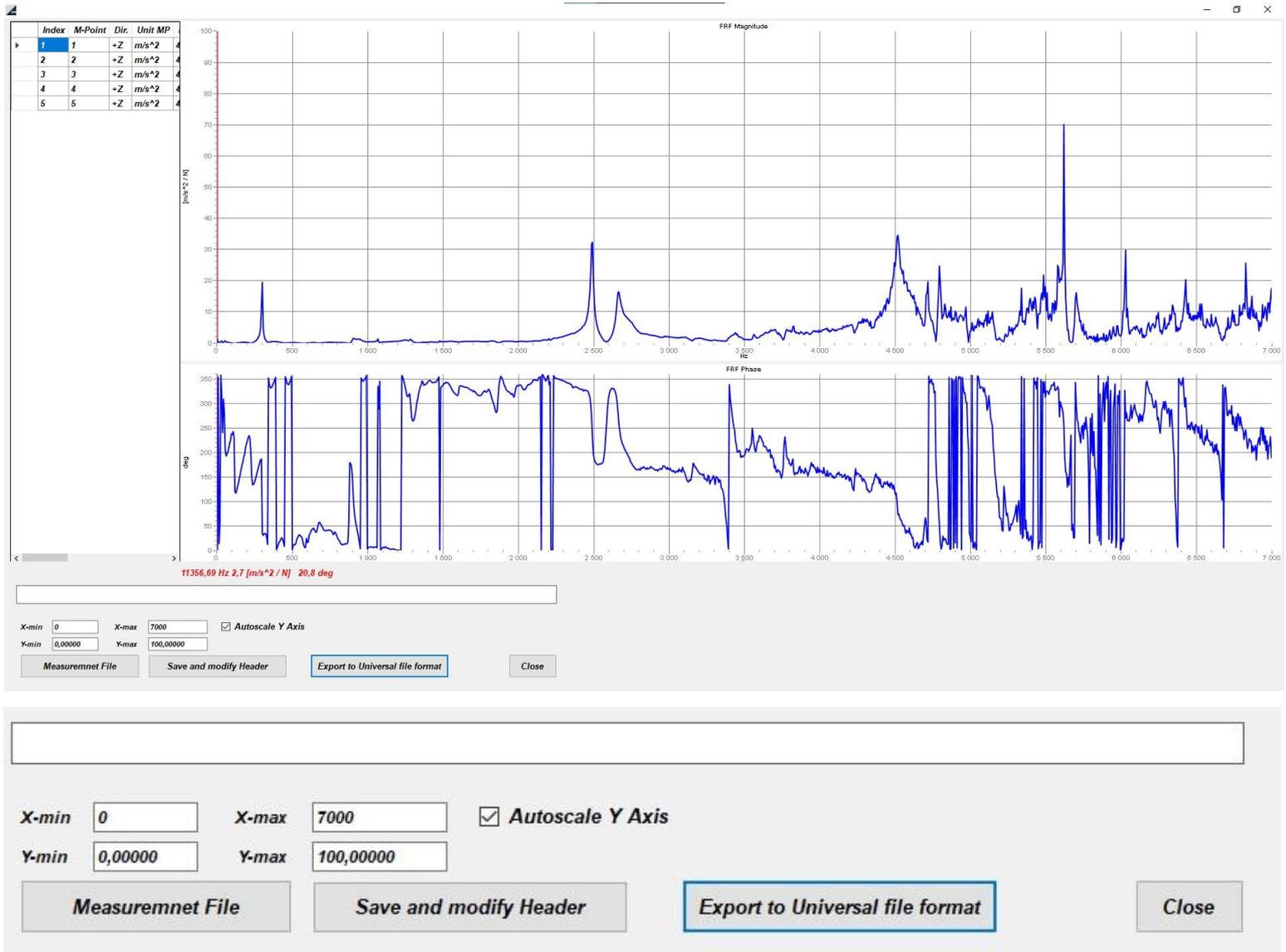
Display

X-min <input type="text" value="0"/>	X-max <input type="text" value="2000"/>
Y-min <input type="text" value="0,00000"/>	Y-max <input type="text" value="10,00000"/>
<input checked="" type="checkbox"/> Autoscale Y Axis	<input type="button" value="Close"/>

To use the FRF-Spectra comparison function the user must load the data that has been pre-recorded using the software for analysis. The user can load up to 25 curves at the same time.

- **LOAD FILE:** load pre-recorded data to be analyzed
- **MULTI CURVE SCALE:** choose the scale that is most suitable for the measurement
- **DRAW:** draw the data

FRF-Spectra Modal analysis

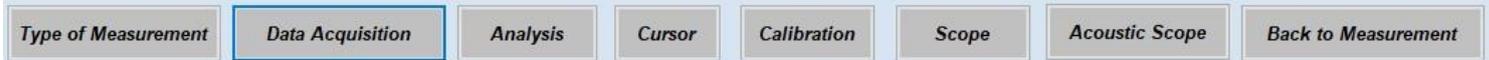


To use the FRF-Spectra Modal analysis function the user must load the data that has been pre-recorded using the software for analysis.

- **MEASUREMENT FILE:** load previously saved measurement
- **SAVE AND MODIFY HEADER:** save the current data
- **EXPORT TO UNIVERSAL FILE FORMAT:** export data to universal file format
- **CLOSE:** exit current screen

Setup Tab

Setup



This is the setup tab here you can choose the type of measurement, setup the channels, choose the type of analysis to perform, customize the display and cursor, calibrate the equipment and choose what the type of measurement you need.

- **TYPE OF MEASUREMENT:** Choose the type of measurement to be performed
- **DATA ACQUISITION:** Channel setup for the type of data that is being analyzed
- **ANALYSIS:** Setup for the type of data to be analyzed
- **CURSOR:** Cursor synchronization
- **CALIBRATION:** Hardware calibration
- **SCOPE:** Oscilloscope function
- **ACOUSTIC SCOPE:** Overall and 1/3 octave analysis
- **BACK TO MEASUREMENT:** Go back to the measurement screen

Data Acquisition

The screenshot shows the 'Sound_Card_HW' software window. It features several configuration sections:

- Global Settings:** Includes 'Size of Ringbuffer' (100 s), 'Maximal Recording time' (10 s), 'Sample Rate' (48000 Hz), 'Sound-device' (0), and 'Channel Range' (5,0 Volt).
- RPM Control:** A section with radio buttons for 'ON' (selected) and 'OFF'.
- Channel 1 and Channel 2 Settings:** Each channel has dropdowns for 'Status' (ON), 'Window' (No window), 'Unit' (Pa), and 'mV / Unit' (10,00000). They also have input fields for 'Offset' (0,000), 'Unit / mV' (0,10000), and 'Value for 0 dB' (0,00002). Channel text is set to 'CH 1' and 'CH 2'.
- RPM-Setup:** A sub-section with 'RPM Channel' (2), 'Pulses / Rev' (1,00), 'RPM Trigger level (Volt)' (1,00), 'No of revolutions for Avg.' (1), and an unchecked 'Auto-Trigger' checkbox.
- Buttons:** 'Apply', 'Save', 'Load', and 'Exit' buttons are located at the bottom.

The data acquisition tab is for setting up and customizing the channels, choosing the buffer size in seconds (Ringbuffer) and the RPM signal type.

The settings chosen can be saved or loaded for later use.

- **SAVE:** Save settings
- **LOAD:** Load saved settings
- **EXIT:** Exit back to main screen
- **APPLY:** Apply selected settings
- **FUNCTION GENERATOR:** Opens a tab to generate your own signal using the software

Analysis Tab

FFT-Analysis

Sample-Rate 48000 Hz
 Bandwidth 18750 Hz
 FFT Block size
 FFT-Resolution 11,719 Hz
 Average Active

Orderanalysis

Order Block size
 Order Resolution
 12,50 Order 4 Revolutions
 Average
 Overlapping

Ringbuffer

Size of Ringbuffer s

FFT-Spectrum and Order-Spectrum

FFT-Waterfall
 Orderanalysis-Waterfall
 Order 1X Amplitude and Phase for Balancing

Overall Frequency band from Hz to Hz

Measurement condition for Waterfall

Run-up RPM Minimum
 Run-down RPM Maximum
 Free Run RPM Step

RPM ON
 RPM OFF

Continuous time domain for Level and 1X

Continuous time domain for Level and 1X

Overall value [m/s²]
 Overall value [mm/s]
 Overall value [µm]
 Order 1X RMS [m/s²] [mm/s] [µm] samples/revolution
 Revolution for Averaging
 Peak-Peak-Value RMS-Value Mean-Value Period s
 Speed in time domain
 Level Monitoring Time interval s

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

Surface dB K1-Factor dB K2-Factor dB

Sound-Power = Level [dB] - Surface [dB] - K1 [dB] - K2 [dB]

Sound-Power max. 10 Microphones

The analysis tab is used to choose what type of data is being analyzed, on this tab the analysis can be fine-tuned to your needs.

- **SETUP RINGBUFFER:** This is used to choose the buffer size
- **APPLY:** Apply the chosen settings
- **LOAD:** Load saved settings
- **SAVE:** Save settings
- **EXIT:** Exit back to main screen

Display Tab

Display Physical functions

Diagr.	Function	Channel	Operator	Filter
1	Signal	1	direct	Lin
2	FFT-Spectrum	1	direct	Lin
3	FRF-Ref 1 Mag.	2	Ref. 1	
4	Signal	2	direct	Lin
5	FFT-Spectrum	2	direct	Lin
6	FRF-Ref 1 Phase	2	Ref. 1	

Multiple curves

Channel	Filter	Color
1	Lin	
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	<input type="checkbox"/> Limit Curve	

Display Settings

Color / Borders /Fonts

Color

Borders

Axis Scaling

Font Labels

Physical functions

Copy Settings of **Diagr. 1**

All 1- 9

X-Y-Type

X min	<input type="text" value="0,00"/>	Y min	<input type="text" value="-1000,00"/>	<input checked="" type="radio"/> Lin	<input type="radio"/> dB
X max	<input type="text" value="0,05"/>	Y max	<input type="text" value="1000,00"/>	Grid	<input checked="" type="checkbox"/>
dX	<input type="text" value="0,01"/>	dY	<input type="text" value="500,00"/>	Grid delta	<input checked="" type="checkbox"/>

Tabular-List

Diagr. 1

This is the display tab, on this tab all the settings related to the display on the main window can be tuned and changed to fit the data being processed (labels, curves colors, borders....) all settings can be saved for later use.

- **COPY SETTINGS TO:** Copy the settings to a specific diagram
- **TABULAR-LIST:** Display tabular list on main window
- **PUT MAJOR FILES:** Load saved files and settings
- **APPLY:** Apply the settings
- **LOAD:** Load settings
- **SAVE:** Save settings
- **EXIT:** Exit to main window

Cursor Setup

Cursor Setup

	Display 1	Display 2	Display 3	Display 4	
Step	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="text" value="1"/>	<input type="checkbox"/> Global cursor

Using this function, the cursor can be synced across all the active displays for easy movement.

Calibration Tab

The interface includes two empty plots for data visualization:

- Signal Plot:** Y-axis is m/s^2 (range -2 to 2), X-axis is s (range 0 to 0.05).
- FFT-Spectrum Plot:** Y-axis is m/s^2 (range 0 to 2), X-axis is Hz (range 0 to 2.000).

Calibration-Type Options:

- 1 g RMS 159 Hz
- g RMS
- m/s^2 RMS
- Mikrophone 94 dB at 1000 Hz
- dB Mikrofon
- Mikrophone 114 dB at 1000 Hz
- Mikrophone 94 dB at 252 Hz

Buttons and Controls:

- Setup Display** (button)
- Average**
- Start** (green button)
- Exit** (button)

Bottom Fields:

- Select Channel to calibrate:** m/s^2
- Calibration factor:** $mV / m/s^2$
- Level:**

On this tab the operator can calibrate the equipment used in the field or in the lab.

- **SETUP DISPLAY:** Choose the scale of the diagram
- **START:** Start the calibration
- **EXIT:** Go back to main screen

Dual Plane Balancing

Balancing_Form
✕

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

Rotor

Balancing setup

Open Balancing

Load

Save

Exit

<i>RPM</i>	<i>Tacho</i>	
<i>Balancing CH</i>	<i>1X -MAG</i>	<i>1X -PHASE</i>
1	2	2
2	2	2

Initial Run

Test run 1

Test run 2

Balancing run 1

Measure

Calculate Balancing

Initial v

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	
<input checked="" type="checkbox"/> Balancing channel 1	<input type="text" value="1"/>	<input type="text" value="1"/>
<input checked="" type="checkbox"/> Balancing channel 2	<input type="text" value="2"/>	<input type="text" value="2"/>
<input type="checkbox"/> Balancing channel 3		
<input type="checkbox"/> 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

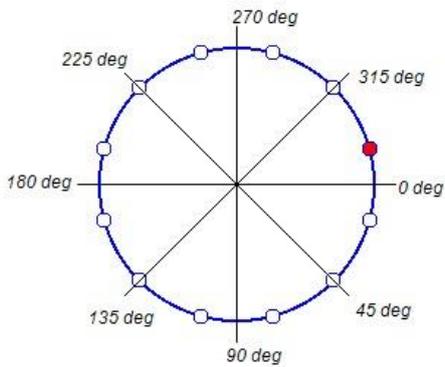
Save Balancing Planes Load Balancing Planes Close

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.

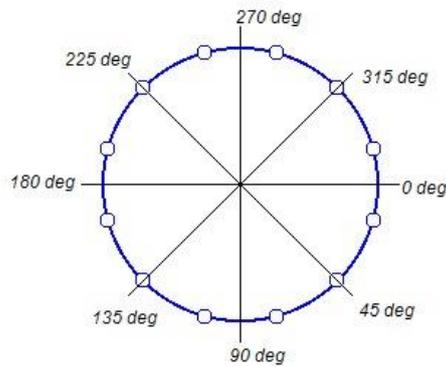
- **BUILD:** Create a balancing plane with the No. of Balancing positions and radius
- **ENTER:** Define a test mass with its position on the rotor
- **APPLY:** Apply the entered parameters
- **DISPLAY PLANES:** Show balancing planes
- **SAVE BALANCING PLANES:** Save settings
- **LOAD BALANCING PLANES:**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

Plane Display

Plane 1 Test Run 1

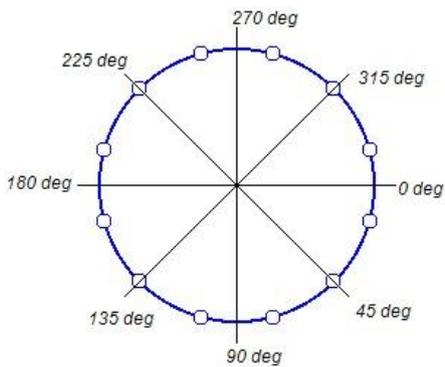


Plane 2 Test Run 1

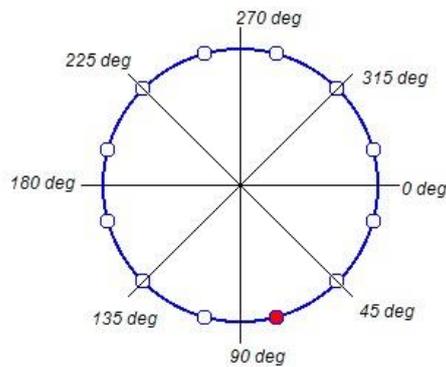


Rotation Counter Clockwise

Plane 1 Test Run 2



Plane 2 Test Run 2



Position of 0°

Close

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*

Balancing results

The screenshot shows a software window titled "Balancing_Form" with a close button in the top right corner. The main content area is titled "Balancing Results" and is divided into two sections for "Plane 1" and "Plane 2".

Plane 1 section:

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

Plane 2 section:

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

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 without 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		

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 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

Imbalance 0,0000 [gmm] 180,0 deg

Balancing Result without removing initial masses

Remove mass

Add mass

Balancing Result without removing initial masses

Plane 1 Rotation Counter Clockwise 270 deg

Imbalance 0,0000 [gmm] 180,0 deg

Balancing Result after removing initial masses

Remove mass

Add mass

Balancing Result after removing initial masses

Plane 1 Rotation Counter Clockwise 270 deg

Imbalance 0,0000 [gmm] 180,0 deg

Keep initial masses Remove initial masses

Set masses Bal. run 1 Remove masses

Load masses Save masse

Delete table Position of 0° Close

Overview of mounted masses

POS	deg	Bal. run 1 mass [g]	Bal. run 2 mass [g]	Bal. 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			

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.

Balancing multiple planes

Rotor

No. of Balancing Planes **No. of Balancing positions** **Start Angle** **Create Balancing Planes**

Radius of Test position **Radius of Balancing position**

Selected balancing Plane **Test run 1**

Test mass on selected balancing Plane

Angle

Position **Enter Test mass** **Save**

Test mass

	POS	Deg	Test radius	Balancing radius	mass Test run 1
▶	1	15,00	15,00	15,00	0,00
	2	45,00	15,00	15,00	0,00
	3	75,00	15,00	15,00	0,00
	4	105,00	15,00	15,00	0,00
	5	135,00	15,00	15,00	0,00
	6	165,00	15,00	15,00	0,00
	7	195,00	15,00	15,00	0,00
	8	225,00	15,00	15,00	0,00
	9	255,00	15,00	15,00	0,00
	10	285,00	15,00	15,00	0,00
	11	315,00	15,00	15,00	0,00
	12	345,00	15,00	15,00	4,48

Plane 1 Test Run 1

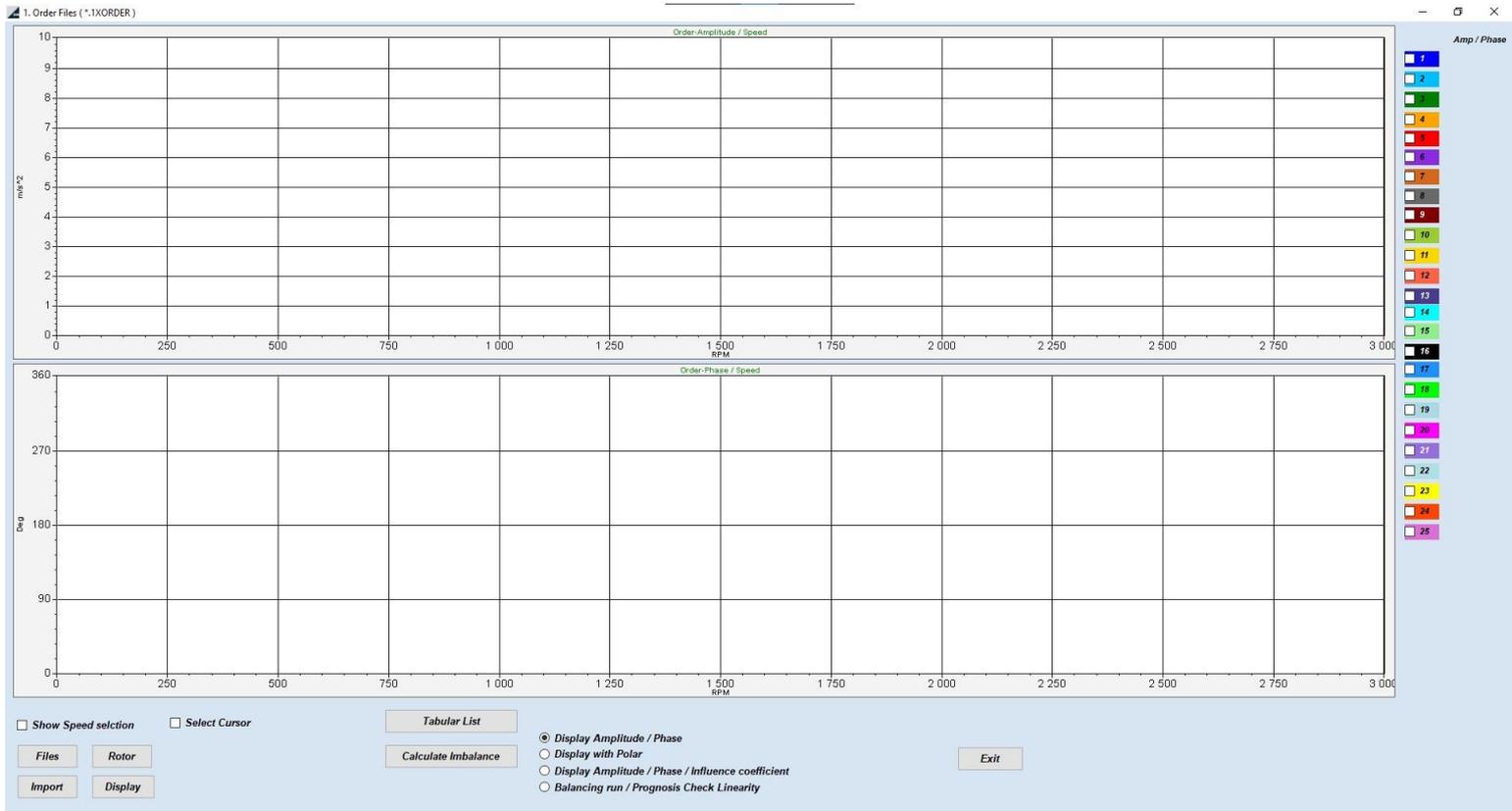
Rotation Counter Clockwise

Save Balancing Planes **Load Balancing Planes** **Position of 0°** **Overview** **Exit**

Using the multiple plane balancing feature the user can define the number of planes on this form then proceed to the next step that is the measurement phase.

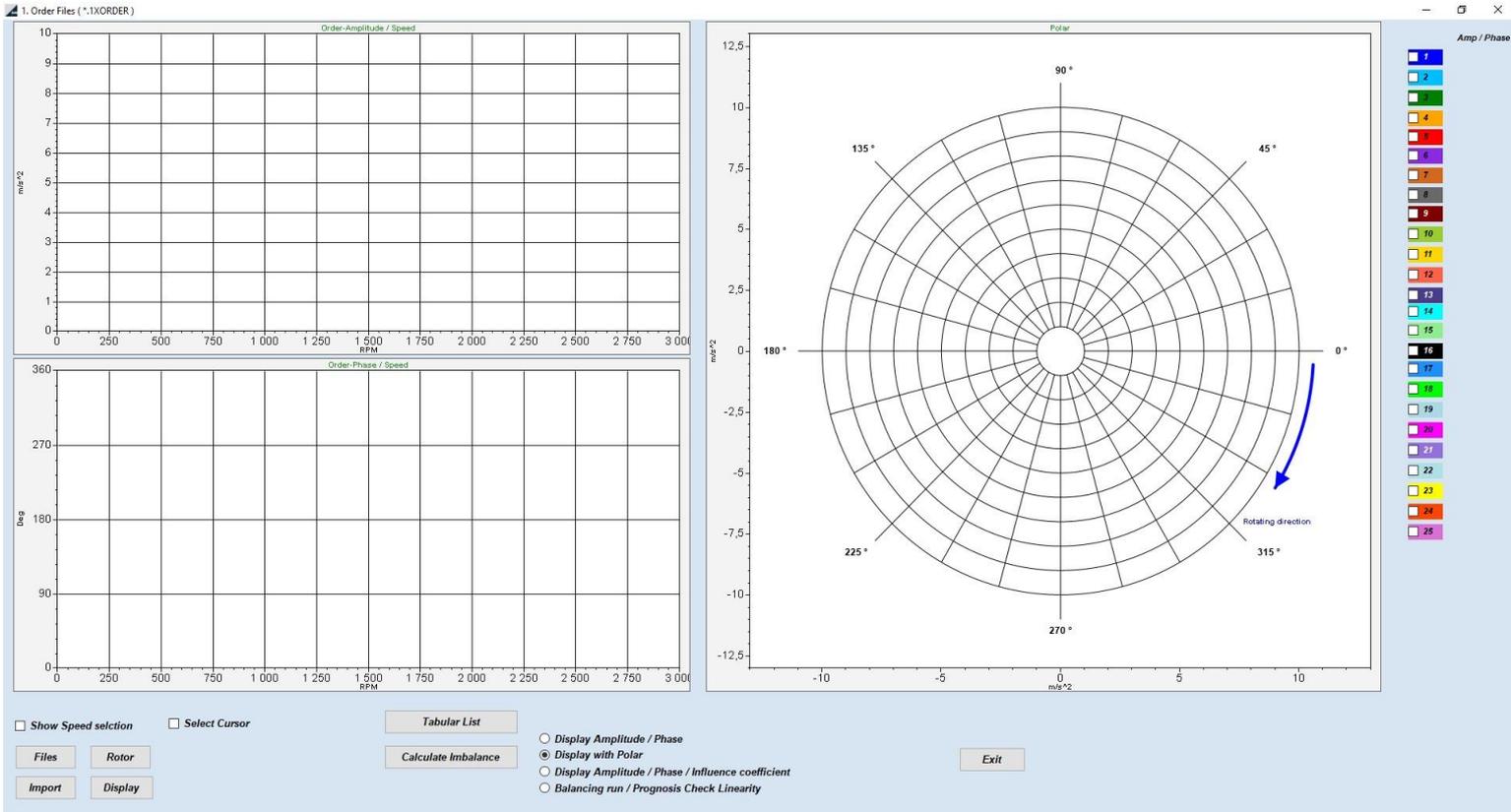
Multiple planes balancing Measurement

Display settings: Amplitude / Phase



Multiple planes balancing Measurement

Display settings: Polar



Multiple planes balancing Measurement

Display settings: Amplitude / Phase / Influence Coefficient

