Ultrasound Solutions

RAPsodyBox

Ultrasound signal generator

User Manual

Version 04 - 2020

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1. Safety

Read carefully the manual before using the RAPsodyBox.

To prevent death or injury risks and a severe damage to the unit and its accessories, use only as specified in this manual. Otherwise, the protection provided by the instrument might be impaired. Make sure that all instructions are fully understood and observed.

To avoid personal injury:

- Do not use if damaged;
- Use caution around rotating equipment and keep cords and straps contained;
- Select a safe location and proceed with utmost care during manipulations when taking readings;
- Do not operate around explosive gas, vapor, and dust or in damp or wet environments;
- Use proper auditive protection, as required by local or national authorities, when working with ultrasound signals.

The power supply of the RAPosdyBox should be only operated at an ambient temperature between 0°C to 45°C up to 95% relative humidity, no condensation. Its storage temperature is between -40°C to +70°C (-40°F to +158°F) 10 to 95% relative humidity. The power supply should never be operated or even stored at places listed below, because this could lead to operating failures:

- Places heavily exposed to moisture or where water condensing may occur;
- Places subject to constant vibrations or to high temperature fluctuations;
- Outdoors.

2. Caution

Do not disassemble the RAPsodyBox. Do not attempt internal alterations. Do not attempt any repairs. Potential damages will not be covered by the Warranty. Contact SDT Ultrasound Solutions or an SDT Authorized Service Provider.

The permissible ambient temperature range for the operation of the RAPsodyBox is -15 °C to +60 °C (14 °F to 140 °F). Relative humidity must be less than 90%, non-condensing.

3. Introduction

The RAPsodyBox is a training tool designed around the 8 application pillars of ultrasound. It can be used to repeatedly reproduce a series of ultrasound scenarios that can be encountered in industry.

The RAPsodyBox includes the following features:

- 1 ultrasound library
- 1 output channel for contact borne
- 1 output channel for airborne ultrasound
- 1 software allowing quick and intuitive navigation
- 128 k samples rate
- 8 GB data memory
- 1 action button
- USB supply and communication
- Bluetooth communication (optional)

4. Unpack

The items that follow are included in your RAPsodyBox kit. Unpack and inspect them.

- RAPpsodyBbox
- USB type B communication cable
- USB stick containing the PC software and documentation

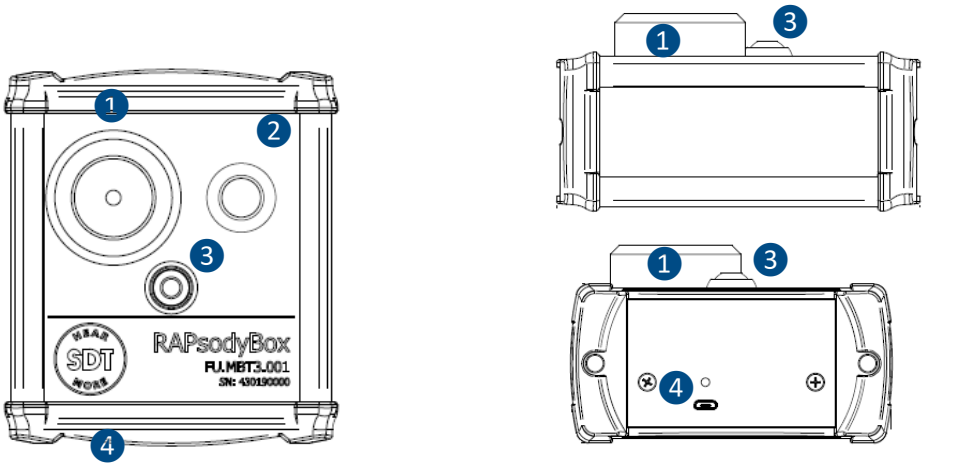
5. Battery (optional)

Caution: **SDT allows the RAPsodyBox to be supply by an external battery. For this use, make sure you have a compatible battery with standard USB power. Also, make sure the external battery is sufficiently charged and perform preferably a complete charge cycle before use.**

Power is provided through a micro USB. Voltage supplied to the power USB should be in the range of **5-5.25V**.

6. Overview

The RAPsodyBox is powered using the USB cable or an external battery. For convenience, the Bluetooth mode is always enabled.



1 Structure borne channel/output
2 Airborne channel/output
3 Action button
4 USB power supply and LED

Figure 6-1 Overview of the RAPsodyBox

The color of the RAPsodyBox status LED indicator 4 shows:

- LED flashes green – the RAPsodyBox is powered and not synchronized with the software on PC.
- LED remains green illuminated– the RAPsodyBox is synchronized with the software and ready to be used.

7. Installation

To be used, the RAPsodyBox should be synchronized with a PC software to be installed beforehand.

7.1. Prerequisites

The RAPsodyBox must be used in association with an ultrasound acquisition device operating in the same frequency ranges. From an ultrasound library, it allows the generation of typical signals for training purposes and for functional testing of ultrasound equipment. The user also has the possibility to interact with ultrasound signals from predefined scenarios.

In order to establish a connection between the RAPsodyBox and a PC, make sure you:

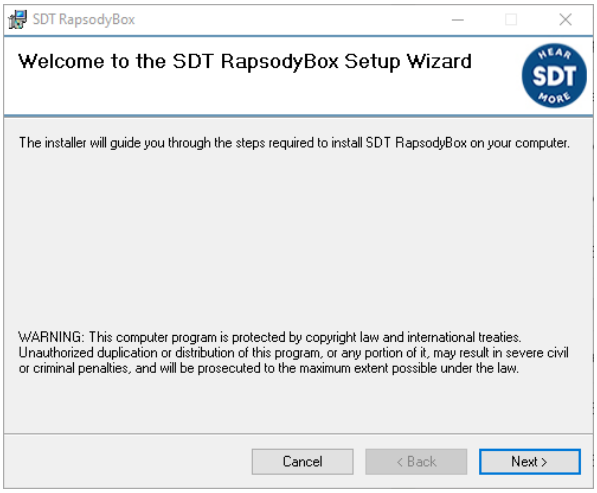
- work on PC windows, 32 or 64 bits, from windows 7
- have ultrasound equipment (sensors + instrument)
- have permission to authorize a coupling through possible firewall
- use the USB cable provided by SDT
- (optional) have a Bluetooth receiver installed and enabled with up-to-date drivers

7.2. Software installation

The software installer is given in the USB stick provided with your RAPsodyBox kit or it can be downloaded from SDT website. The software allows to easily choose the ultrasounds to generate from a didactic and labelled database.

Proceed as follows:

1.



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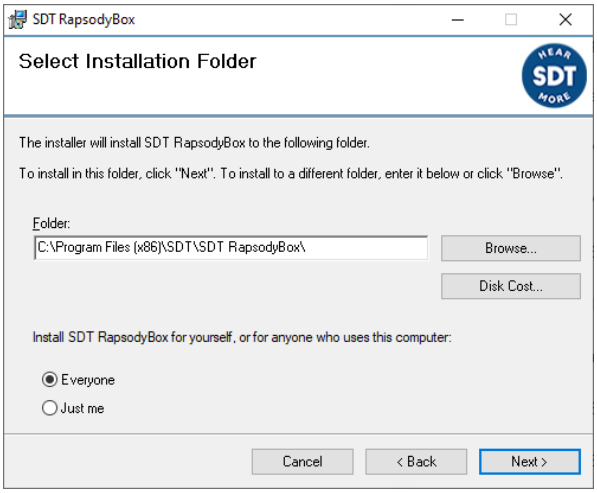

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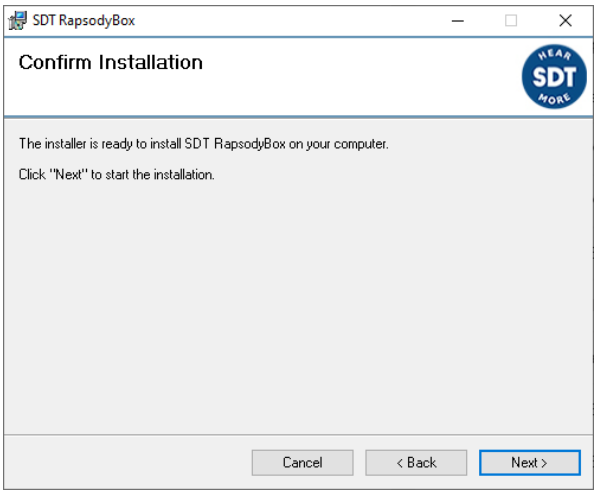

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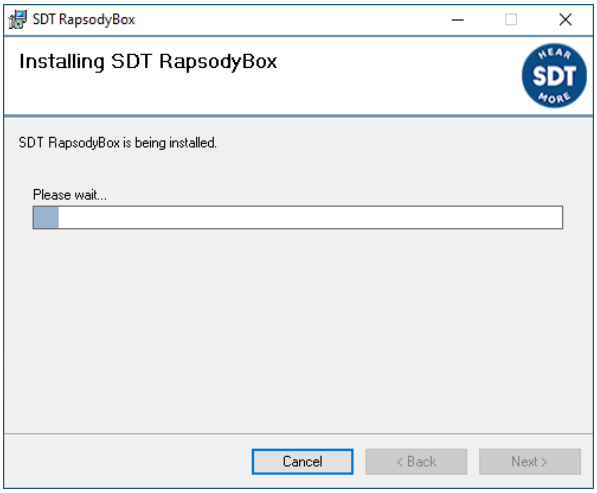


5.

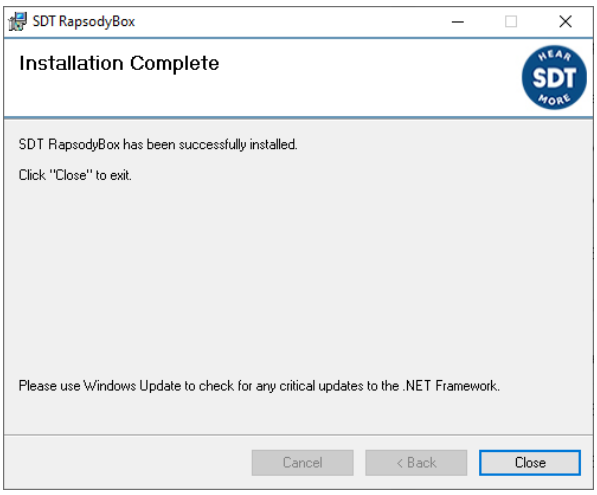


Figure 7-1: Software installation

7.3. Registration

The first launch of the software leads to the registration screen. Upon validation of the order, a license will be assigned. The instructions will be delivered by mail from the following address noreply@sdtultrasound.com.

SDT Extranet :: License assigned [# 10950][S/N 606310720][SDT International]

SI SDT INTERNATIONAL
To
Cc

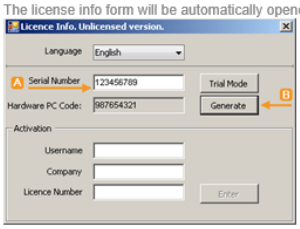
Dear

The following license has been assigned to you. [view on site]

ID	Type	Serial No	License No	Assigned to	Article code	Comment	PO no.
10950	RapsodyBox	606310720	not yet activated		FASFTWRAP01		

Quick guide

1. **Install the software** on the destination computer.
2. Generate your computer's **hardware code**:
   - Start the software.
   - The license info form will be automatically opened:



   - There, enter the serial number of your license.
   - ...and click the "Generate" button.
3. Then go to the **license activation page** and follow the instructions.

Figure 7-3: Instructions for registration

You may need to check you spam folder.

7.4. USB Network (optional, recommended)

Once the software is installed and registered, connect the RAPsodyBox to the computer using the provided USB cable. After a few seconds, the LED will flash green and the following message should appear on Windows.

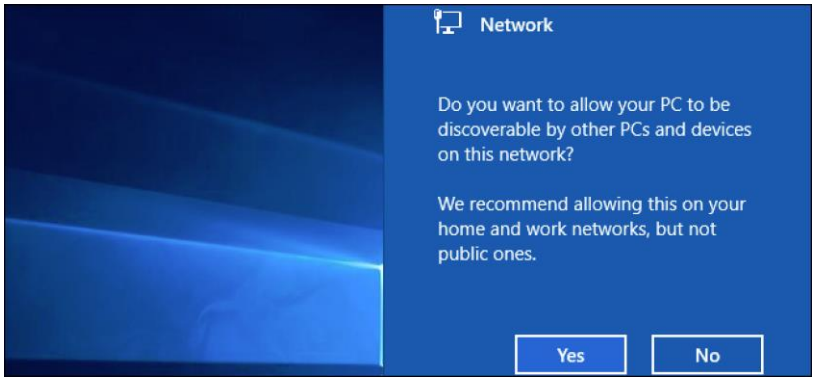


Figure 7-4: Network confirmation on Windows

Allow the network connection by clicking on **Yes**. The RAPsodyBox is now ready to be synchronize with the software.

7.5. Bluetooth pairing (optional)

Note:

Make sure your computer is equipped with a Bluetooth device.

See: https://support.microsoft.com/en-us/help/15290/windows-connect-bluetooth-device

Power on the RAPsodyBox by connecting the USB cable to an external battery or a PC. Once the LED flashes green, the RAPsodyBox is automatically discoverable with its serial number as Bluetooth ID.

Turn on Bluetooth on your PC Windows. To do this, on the task bar, select action center, then, Bluetooth or **Start** > **Settings** > **Devices** > **Bluetooth & other devices, as below:**

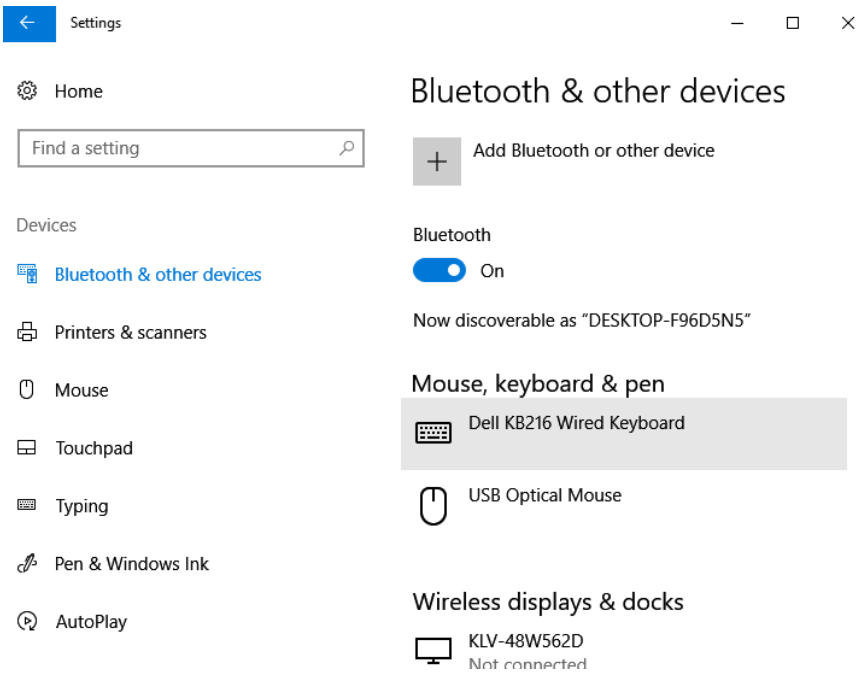
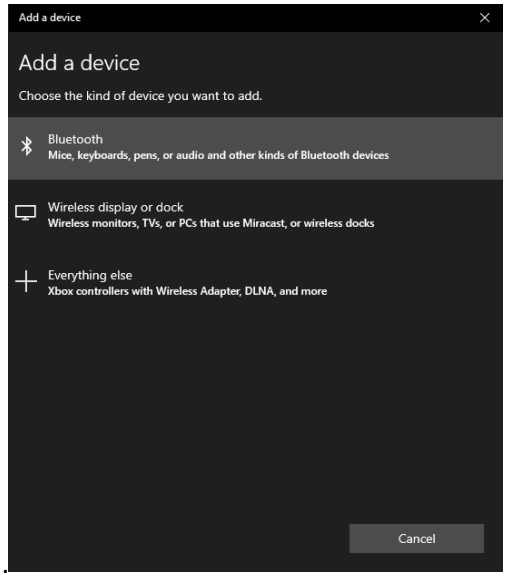
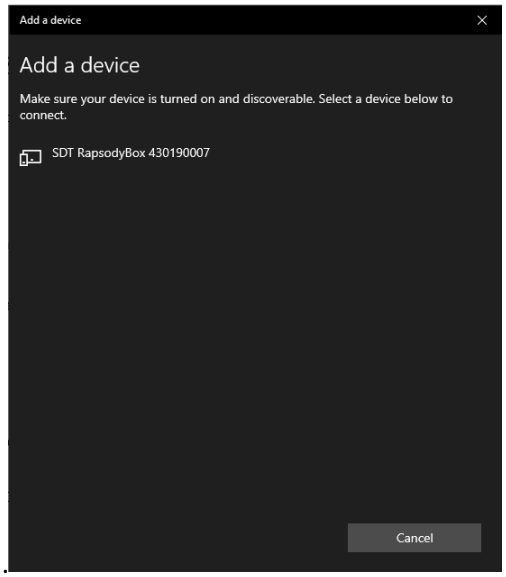


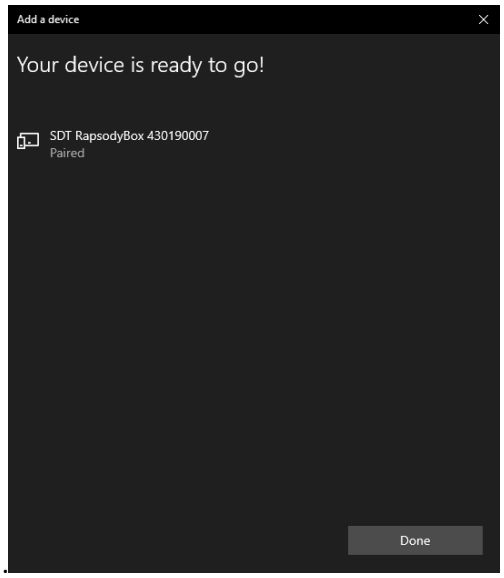
Figure 7-5-1: Bluetooth settings on Windows

Press **Add Bluetooth or other devices** and proceed as follows:

1. 

2. 

3.



4.

Figure 7-5-2: Pairing Bluetooth on Windows

Once detected and identified with the serial number 43019xxxx, the RAPsodyBox can be paired with the PC.

7.6. Plug & Unplug a Sensor and compatibility with SDT devices

The RAPsodyBox has 2 output channels identified as contact borne/vibroacoustic borne and airborne.

SDT sensors are used to measure ultrasound signals generated by the RAPsodyBox. The Structure borne is dedicated to vibroacoustic measurement beyond 20 kHz where the signal is propagated through materials. In this case, an RS2T or an equivalent sensor should be screwed on the channel. It typically concerns mechanical issues generating from gearbox, bearings, poor lubrication, steam traps, valves, etc

Otherwise, the airborne channel is used to generate typical ultrasounds that can be emitted from electrical plant, leak, hydraulic plants, etc that travel in the air.

Channel	SDT instrument	Recommended SDT sensors
Structure borne (>20 kHz)	• 340, 270, 200, etc • LubExpert • Checkers	• RS1T, RS2T, RS3T • Lubsense • RSNL100,200,500
Airborne	• 340, 270, 200, etc • Checkers	• EDS, FlexID1, FlexID2 • Airsense • Ultrasense • Paradish

Figure 7-6: Recommended use of SDT equipment with RAPsodyBox

8. Software

By default, the software runs in **Passive mode**. The user can click on **Update** button to get the latest software update. The default mode allows the user to play existing signals from a labelled ultrasound library without the possibility of interacting with them, accepted by the volume adjustment. The user can also switch to **Interactive mode** by clicking on **View** to benefit from advanced features that are particularly advised for the lubrication pillar.

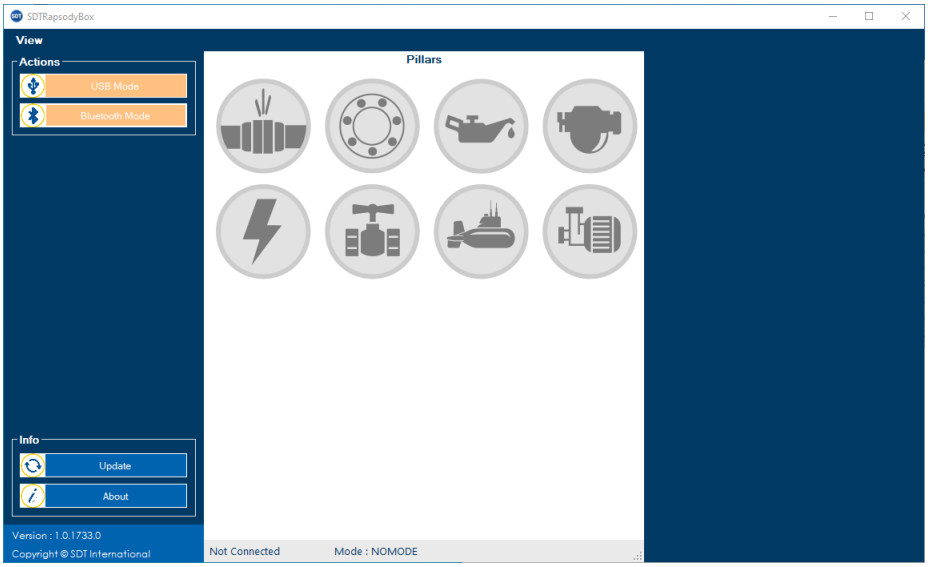


Figure 8- Home screen before synchronization

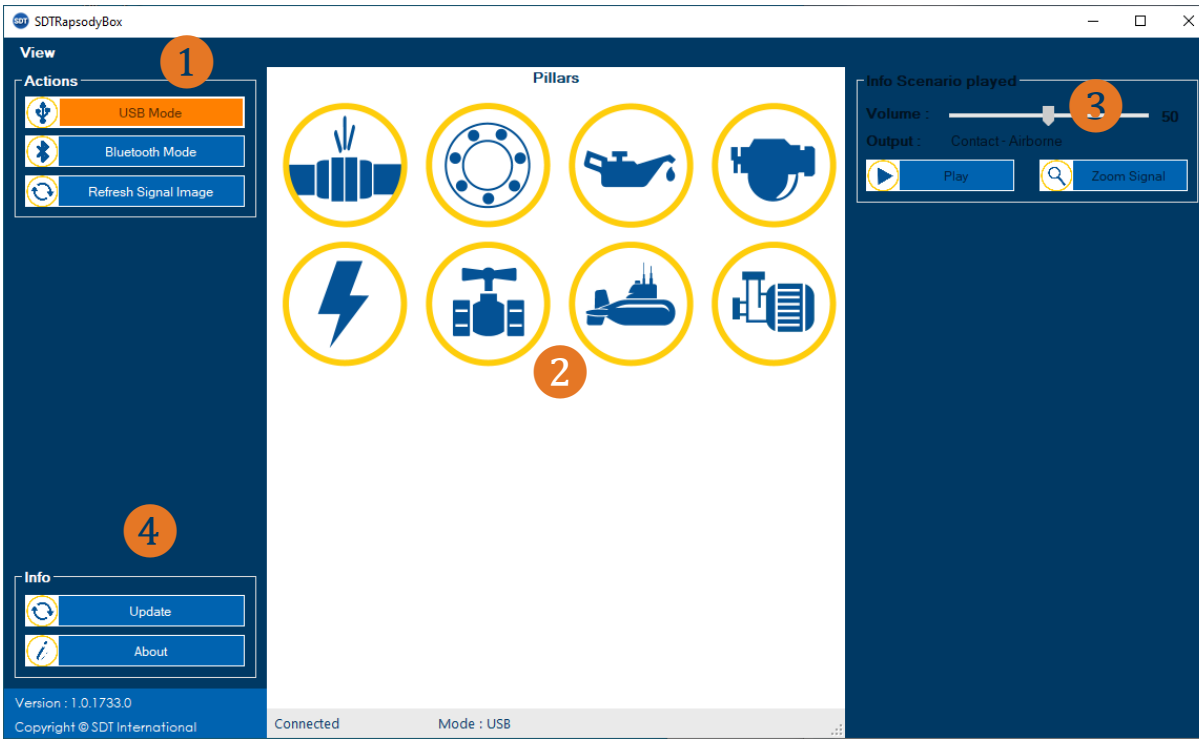
As long as connection is not achieved via **Actions** panel, button **USB mode** and button **Bluetooth mode** blink and “Not Connected” is mentioned in the bottom banner.

8.1. Passive mode

The colorized Home screen in **Passive mode** is displayed after synchronization in **USB Mode** or in **Bluetooth mode**.

Click on one of these two blinking actions mode and wait a few seconds. Once connected with the RAPsodyBox, the following screen appears, the 8 pillars in color are unlocked and “Connected” is mentioned in the bottom banner with the associated connection mode.

A brief description of the main interface is given hereafter:



1 Connectivity button

2 Ultrasound library around the 8 pillars

3 Description of data and volume adjustment

4 Update & legal information

Figure 8-1.1 Home screen once connected in Passive mode

On top left, 1, **Actions** area is composed of 3 buttons and becomes orange when the connection and synchronization between the RAPsodyBox and PC is established according to chapter **7. Installation**. Once it's done, the 8 icons describing the ultrasound pillars turn color 2 and the user can choose which pillar to browse. Doing so, you have the possibility to select from a database of WAVE files, typical ultrasound signal to playback. A brief description of each signal as well as a graph composed of the time waveform, Fourier transform and spectral envelope are given to help in the understanding of the ultrasound phenomenon.

When selecting an ultrasound pillar, the associated icon changes into orange . Depending on the complexity related to the desired ultrasound application, several additional icons describing training scenario appear in 2. Each scenario contains several sound files to play where additional details are given in 3. To benefit from more contents, make sure to keep the software up to date using the **Update** button 4.

An example is given bellow, when browsing in Electrical pillar:

Figure 8-2.2 Example

WAVE files appear in a pop up associated with each scenario. Double-click on the desired one to play the signal in repeat mode. Therefore, the main screen displays the description of the training signal. Each user can identify where the signal comes from, with which type of sensor it can be measured and what are the main characteristics of the audio file, related to the acquisition mode. Normalized

Temporal and spectral representations are also toggle in a dedicated box. Finally, the user can adjust volume of the signal that has to comply with the measuring device.

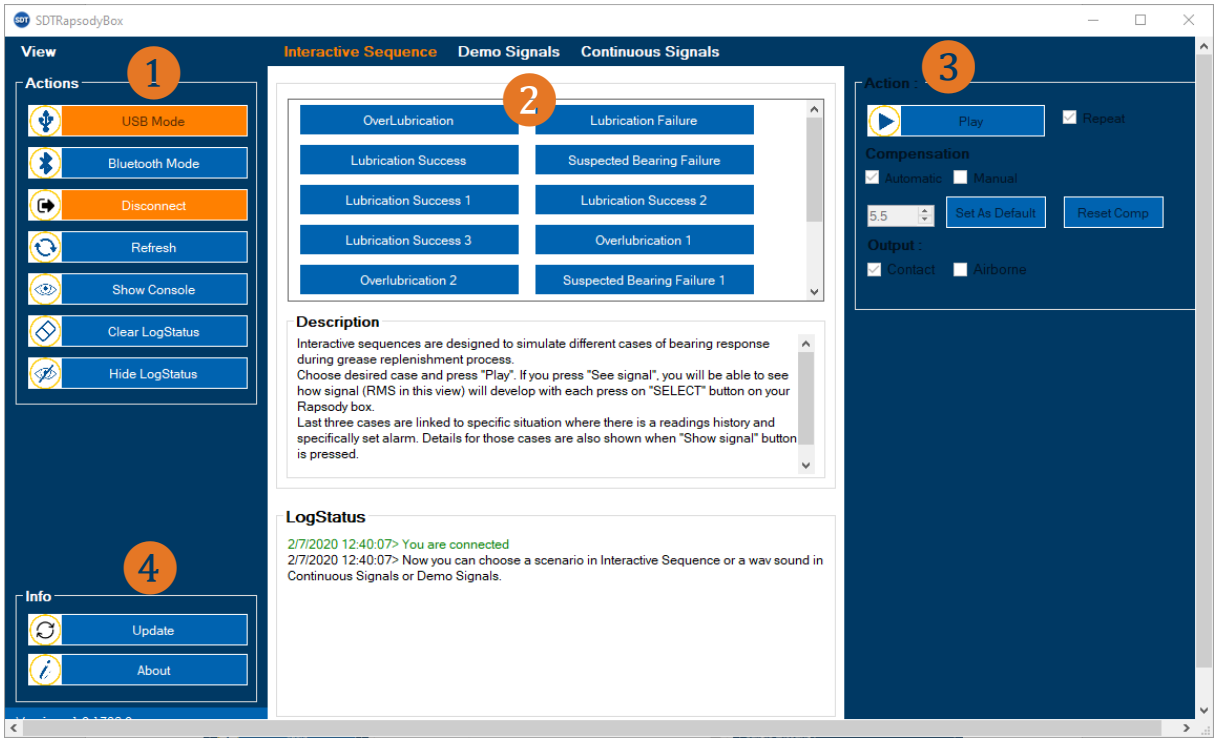
To appreciate or acquire the signal being played, you can approach an SDT instrument fitted with an ultrasound sensor as close as possible to the desired output channel. A measurement can be taken and compared with the reference signal.

The user may want to import ultrasound files.wav by using the dedicated button:

These non-heterodyne files can be retrieved from UAS software programs but the description of these custom signals won't be accessible.

8.2. Interactive mode

In Interactive mode, user can interact with the signal by pressing the action button.



1 Advanced actions area

2 Ultrasound scenario for lubrication and search capabilities through database with the banner located at the top

3 Description of data and volume adjustment

4 Update & legal information

Figure 8-2.1 Home screen once connected in Interactive mode

Interactive sequences are designed to simulate different cases of bearing response during grease replenishment process. Choose a scenario sequence in 2 and press "Play" in 3. Additional information like how signal (RMS value) will behave after each press on "action" button simulating a grease replenishment are given.

You can also explore the entire ultrasound database by browsing in **Demo Signals** and **Continuous Signals.**

An example of a lubrication scenario is given hereafter:

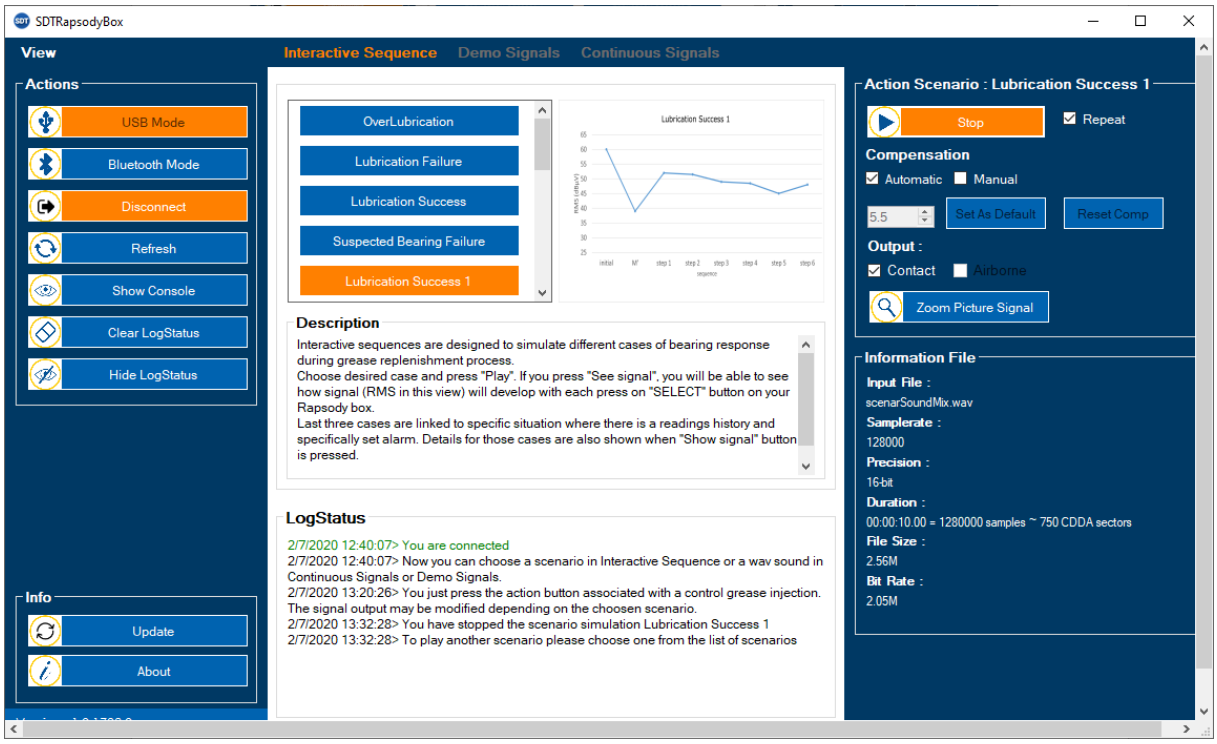


Figure 8-2.2 Example with scenario Lubrication success 1

When pressing “Play” button, the signal is initially emitted from the contact borne channel at a predefined RMS level of 60 dB. The user is invited to fit a contact sensor of type RS2T or LubSense to the contact borne in order to appreciate the measurement through an acquisition device. When you interact with action button on the RAPsodyBox, the initial signal is modified depending on the selected scenario and goes to value given at step 1. M’ denotes a transition value after a first grease injection simulation. Each step is associated with an elementary grease shot triggered when the user press action button.

The RAPsodyBox is delivered with a pre-compensation in 3. In case of difference between the desired ultrasound level and value measured with an SDT device, you may want to adjust the compensation value in order to exactly match with the scenario. To achieve this, proceed as follow:

- Define Compensation value as ManualAdd a new value in the field (example: replace 5.5 by 7.5 if there is a difference of 2 dBµV)Validate with “Set As Default” and click “yes” in the pop-up window (factory value could be restore at any moment)

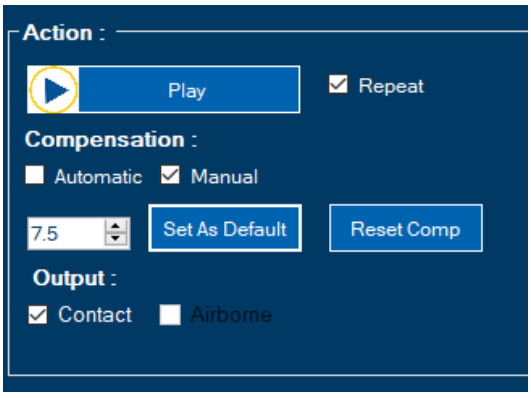
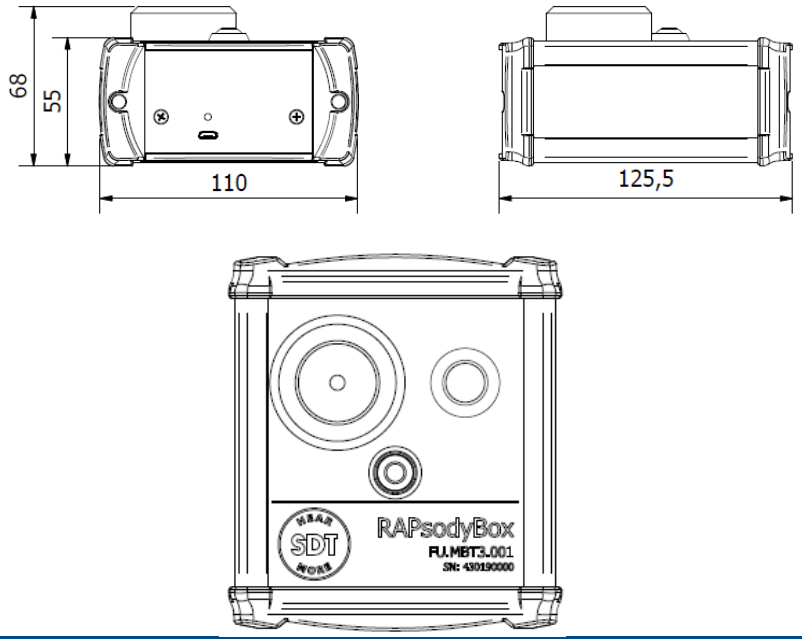
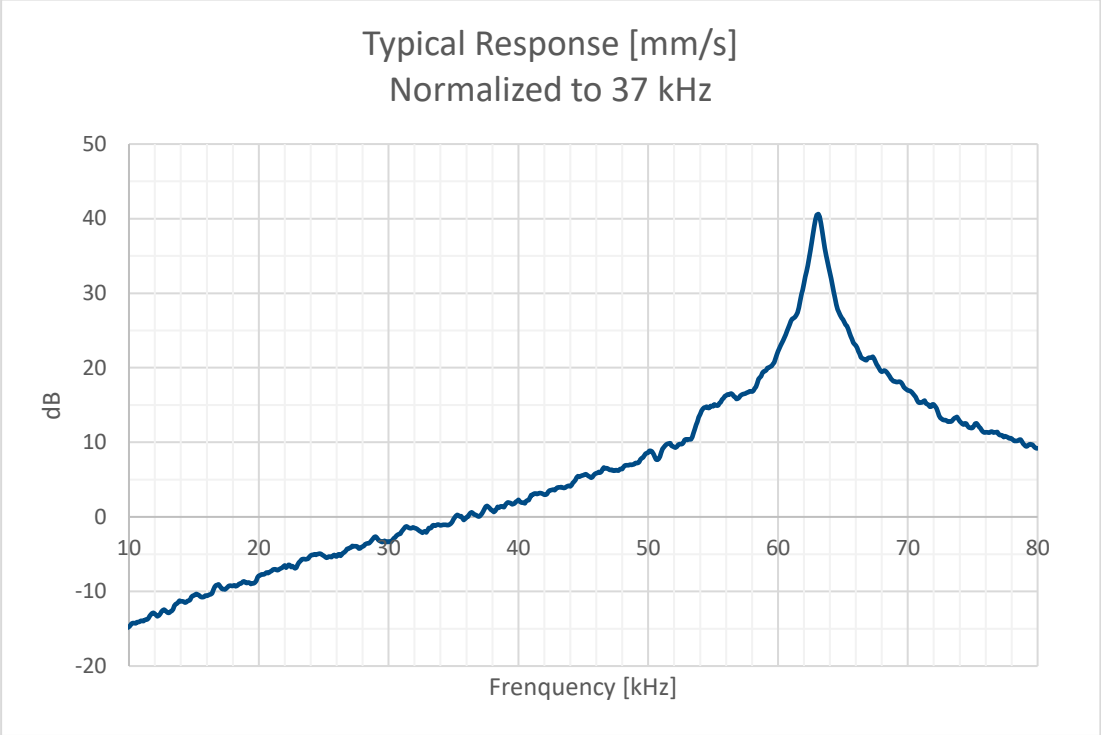


Figure 8-2.3 Adjusting compensation

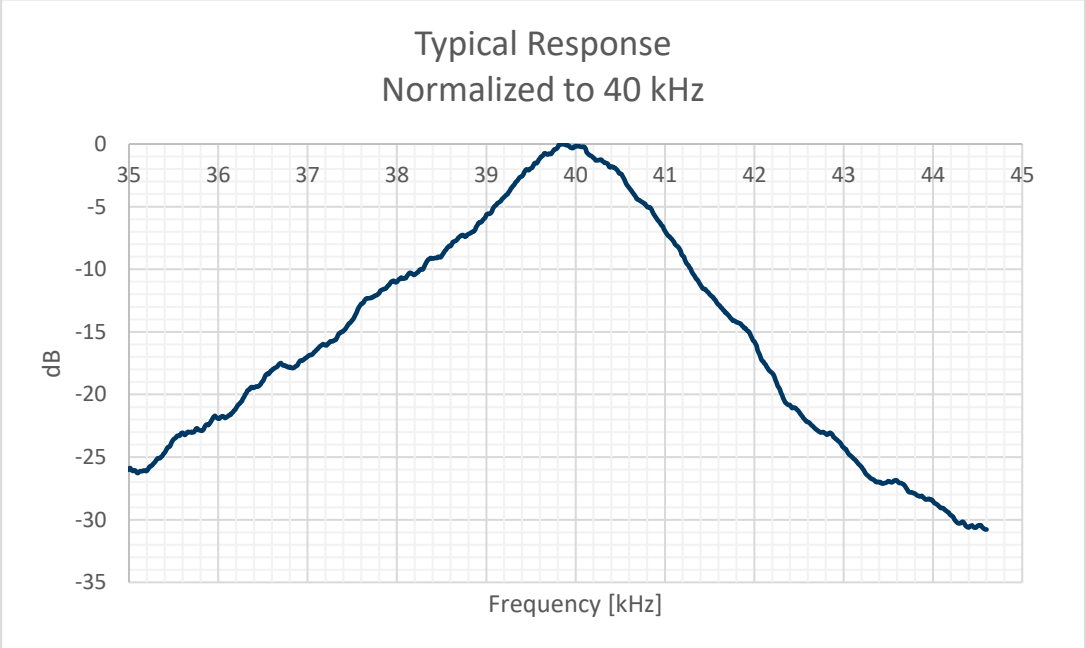
9. Technical specifications

System features	
Operating system	Linux
CPU	400 MHz ARM9
Data memory	8 GB
Communication	Micro USB type B and Bluetooth
Signal processing	
Dynamic range	109 dB
Resolution	16 bits
Signal length	Depending on WAVE files
Signal outputs	
Structure borne transducer	Resonant frequency ~ 60 kHz
Mounting	Thread M6 for ultrasound sensor
Signal amplitude range	50 dB
Airborne transducer	Resonant frequency ~ 40 kHz ± 1 kHz
Bandwidth (-6 dB)	2kHz
Transmitting sound level at max volume	100 dB_{SPL} at 1 m (with sine wave)
Total beam angle (-6 dB)	55°
Mechanical characteristics	
Materials	Anodized aluminum profile / plastic lid: ABS
Dimensions [mm]	
Weight	520 g
IP rating	40
Power supply	
USB	Default usage
Battery	Optional, autonomy depending on capacity

Typical response curve of Structure borne transducer:



Typical response curve of airborne transducer:



10. Optional calibration intervals (if applicable)

SDT recommends **annual** recalibration of SDT instruments and **annual** verification of sensors and transmitters to benefit from its **limited lifetime warranty**. This periodicity is coherent with the observed long-term stability of SDT electronic equipment's.

However:

- The RAPsodyBox is not intended to be used as a reference transmitter for calibrating SDT sensors.
- The RAPsodyBox is designed to be used as a training tool where the user can manually adjust the compensation factor.

For these reasons, SDT calibrates the device by assigning a factory/default compensation factor.
For user's convenience, the user may change this default value, in the Interactive mode menu.

This text refers to SDT document DC.QUAL.005[1]

11. Warranty

SDT International guarantees the RAPsodyBox against manufacturing faults for unlimited period, provided that the device is used in accordance with section **2.Caution**

The limited lifetime warranty covers all material supplied and implies the free replacement of all parts that contain a manufacturing fault.

The limited lifetime Warranty does not include shipping, handling and importation.

The limited lifetime warranty is void if misused, or accident damages the product, if the product is altered in any way, if an unauthorized party attempts repair, or the unit is opened without written authorization of SDT International.

In the event of a defect, contact your local SDT representative or SDT International.

12. Responsibility limits

Neither the company SDT International, nor any related company, will in any circumstances be liable for any damages, including, without limitation, damages for loss of business, business interruption, loss of information, defect of the RAPsodyBox unit or its accessories, bodily harm, loss of time, financial or material loss or any other indirect or consequential loss arising out of the use, or inability to use this product, even when it has been warned of possible damages.

13. Destruction and recycling of waste equipment

In conformance with European Union (EU) Directives and in particular with Directive 2012/19/EU "WEEE – Waste Electrical and Electronic Equipment", SDT International is organizing the management of waste equipment. However, local legal regulations have precedence.

Thus, SDT Customers may:

[1] This document is part of SDT's quality management system (ISO-9001 certified).

- Either transfer a waste apparatus to a local company that will recycle it in accordance with applicable local laws;
- Return the waste apparatus to SDT International or to a SDT Dealer;
- For an apparatus that contains a battery, SDT International will transfer the battery to a local company that will recycle it in accordance with EU "Batteries" Directive and Belgian laws.

SDT International will transfer the rest of the apparatus to a local company that will recycle it in accordance with EU "WEEE" Directive and Belgian laws.

14. Copyright

The information herein is believed to be accurate to the best of our knowledge.

Due to continued research and development, specifications of this product can change without prior notice.