

RAPsodyBox

Ultrasound signal generator



User Manual

Version 04 - 2020

SDT International sa-nv • Bd de l'Humanité 415 • B-1190 Brussels (Belgium) • Tel: +32(0)2 332 32 25 • email: info@sdtultrasound.com SDT North America • 1532 Ontario Street, Cobourg, ON • Phone: 1-800-667-5325 | 1-905-377-1313 • email: hearmore@sdtultrasound.com www.sdtultrasound.com

Table of Contents

1.	Sa	Safety 3				
2.	Са	Caution				
3.	Int	troduction3				
4.	Ur	npack				
5.	Ba	attery (optional)				
6.	0	verview				
7.	Ins	stallation5				
	7.1.	Prerequisites				
	7.2.	Software installation5				
	7.3.	Registration6				
	7.4.	USB Network (optional, recommended)7				
	7.5.	Bluetooth pairing (optional)7				
	7.6.	Plug & Unplug a Sensor and compatibility with SDT devices				
8.	So	ftware10				
	8.1.	Passive mode10				
	8.2.	Interactive mode				
9.	9. Technical specifications					
10). Recommended calibration intervals1					
11	. Warranty 17					
12	. Responsibility limits					
13	. De	. Destruction and recycling of waste equipment 17				
14	. Copyright					



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.





4 USB power supply and LED



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 <u>SDT website</u>. The software allows to easily choose the ultrasounds to generate from a didactic and labelled database.

Proceed as follows:

1.	2.
妃 SDT RapsodyBox — 🗆 🗙	😸 SDT RapsodyBox — 🗆 🗙
Welcome to the SDT RapsodyBox Setup Wizard	Select Installation Folder
The installer will guide you through the steps required to install SDT RapsodyBox on your computer.	The installer will install SDT RapsodyBox to the following folder. To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
	Eolder: C:\Program Files (x86)\SDT\SDT RapsodyBox\ Disk Cost
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.	Install SDT RapsodyBox for yourself, or for anyone who uses this computer: Everyone Just me
Cancel < Back Next >	Cancel < Back Next >



3.		4.	
🚽 SDT RapsodyBox —	□ ×	🛃 SDT RapsodyBox	- 🗆 X
Confirm Installation	SDT Mort	Installing SDT RapsodyBox	SDT MORE
The installer is ready to install SDT RapsodyBox on your computer. Click "Next" to start the installation.	Nexts	SDT RapsodyBox is being installed. Please wait	
5. # SDT RapsodyBox – Installation Complete			
SDT RapsodyBox has been successfully installed. Click "Close" to exit. Please use Windows Update to check for any critical updates to the .NET Frame	work.		
Cancel < Back	Close		

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 <u>noreply@sdtultrasound.com</u>.



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



Dear

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

ID	Туре	Serial No	License No	Assigned to	Article code	Comment	PO no.
<u>10950</u>	RapsodyBox	606310720	not yet activated		FASFTWRAP01		

Quick guide

1. Ins 2. Ge	stall the software on the destination computer. enerate your computer's hardware code: Start the software. The licence info form will be automatically opened:	
	Licence Info. Unlicensed version.	
	Language English •	
	Serial Number 123456789 Trial Mode	
	Hardware PC Code: 987654321 Generate	
	Activation	
	Username	
	Company	
	Licence Number Enter	
	There, enter the serial number of your license.	
	and click the "Generate" button.	
3. Th	nen 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)

Make sure your computer is equipped with a Bluetooth device.

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



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:**

← Settings	- 🗆 X				
© Home Bluetooth & other device					
Find a setting	+ Add Bluetooth or other device				
Devices	Bluetooth				
Bluetooth & other devices	On				
品 Printers & scanners	Now discoverable as "DESKTOP-F96D5N5"				
Mouse	Mouse, keyboard & pen				
Touchpad	Dell KB216 Wired Keyboard				
📾 Typing	USB Optical Mouse				
c∄ Pen & Windows Ink					
AutoPlay	Wireless displays & docks				
	LT KLV-48W562D Not connected				
Figure 7-5-1: Bluetooth settings on Windows					

Press Add Bluetooth or other devices and proceed as follows:









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, etcCheckers	 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.



i SDTRapsodyBox			X
View Actions USB Mode Bluetooth Mode CRefresh Signal Image		Pillars	Info Scenario played Volume :50 Output : Contact-Airborne Play Q Zoom Signal
4 Info Update About Version : 1.0.1733.0 Conside # 050 Liston chinal	Connected	Mode - 1158	
Copyright © SDT International	Connected	Mode : 058	

A brief description of the main interface is given hereafter:

- Connectivity button
- 2 Ultrasound library around the 8 pillars
- Oescription of data and volume adjustment
- 4 Update & legal information

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.



Figure 8-1.1 Home screen once connected in Passive mode

SDTRapsodyBox				- D >	<
View					
Actions		Pillars		Info Scenario played	ή
USB Mode			\frown	Volume : 50	
Bluetooth Mode				Output : Contact - Airborne	
Refresh Signal Image				Play Zoom Signal	
Pillars					
Leaks					
Mechanical		i=) (🚢) (
Lubrication					
Steam		Scenarios			
Electrical	\frown		🜚 Files	- 🗆 X	
Valves	Arcing Corona	Destructive Corona Corona	Destructive corona.w	av	
Tightness					
Hydraulics					
O Update					
About					
Version : 1.0.1733.0					
Copyright © SDT International	Connected Mode :	USB			

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.

SDTRapson	dyBox				- 🗆 X
View		Interactive Sequence Demo S	ignals Continuous Signals	- 3	<u>^</u>
Actions-			2	Action :	
	USB Mode	OverLubrication	Lubrication Failure	Play	🗹 Repeat
	Bluetooth Mode	Lubrication Success	Suspected Bearing Failure	Compensation	
	Disconnect	Lubrication Success 1	Lubrication Success 2	5.5 🔶 Set As Default	Reset Comp
\odot	Refresh	Lubrication Success 3	Overlubrication 1	Output :	
	Show Console	Overlubrication 2	Suspected Bearing Failure 1	✓ Contact Airborne	
\otimes	Clear LogStatus	Description Interactive sequences are designed to	simulate different cases of bearing response	^	
	Hide LogStatus	during grease replenishment process. Choose desired case and press "Play". how signal (RMS in this view) will deve Rapsody box. Last three cases are linked to specific t specifically set alarm. Details for those is pressed.	If you press "See signal", you will be able to see slop with each press on "SELECT" button on your situation where there is a readings history and cases are also shown when "Show signal" butto	n V	
		LogStatus			
	Update About	2/7/2020 12:40:07> You are connected 2/7/2020 12:40:07> Now you can choose Continuous Signals or Demo Signals.	e a scenario in Interactive Sequence or a wav so	und in	
<					>

Advanced actions area

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

Oescription 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.



SDTRapsodyBox			×
View	Interactive Sequence Demo Signals	s Continuous Signals	^
Actions			Action Scenario : Lubrication Success 1
USB Mode	OverLubrication	Lubrication Success 1	Stop 🗹 Repeat
Bluetooth Mode	Lubrication Failure	60 55 § 50	Compensation
Disconnect	Lubrication Success		5.5 Set As Default Reset Comp
CO Refresh	Suspected Bearing Failure	20 30 	Output :
Show Console	Lubrication Success 1	seguroze	Contact Airborne
Clear LogStatus	Description	te different cases of bearing response	
Hide LogStatus	Autionary season of the season	oress "See signal", you will be able to see h each press on "SELECT" button on your n where there is a readings history and are also shown when "Show signal" button	Information File
Update	LogStatus 2/7/2020 12:40:07> You are connected 2/7/2020 12:40:07> Now you can choose a scer Continuous Signals or Demo Signals. 2/7/2020 13:20:26> You just press the action bu The signal output may be modified depending of 2/7/2020 13:32:28> You have stopped the scen 2/7/2020 13:32:28> To play another scenario pla	nario in Interactive Sequence or a wav sound in itton associated with a control grease injection. on the choosen scenario. ario simulation Lubrication Success 1 ease choose one from the list of scenarios	Totat Duration : 00.00:10.00 = 1280000 samples [~] 750 CDDA sectors File Size : 2.56M Bit Rate : 2.05M

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 popup window (factory value could be restore at any moment)

Action :		
	Play	✓ Repeat
Compensat	ion : ✓ Manual	
7.5 🚔	Set As Default	Reset Comp
Output : ☑ Contact	Airborne	

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	Anodize	ed 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.005¹

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

© 2018 SDT International n.v. s.a.

All rights reserved.

No one is permitted to reproduce or duplicate, in any form, the whole or part of this document without the written permission of SDT International n.v. s.a.

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.

