

Table of Contents

1	Installation.....	1
1.1	Download.....	1
1.2	Compatibility.....	1
1.3	Licensing.....	1
1.3.1	Requesting an evaluation license.....	1
1.3.2	Activating the evaluation license.....	2
1.4	Plug-in installation.....	2
2	Introduction.....	3
3	Setup microphones.....	4
3.1	Microphone calibration.....	4
4	Setup SoundPower.....	5
4.1	Basic.....	6
4.1.1	ISO standards.....	6
4.1.2	Microphone positions.....	6
4.1.3	Device type/size.....	7
4.1.4	Geometry distances.....	7
4.2	Microphone setup.....	7
4.3	Microphone positions.....	7
4.4	Triggers.....	8
4.4.1	One trigger channel.....	8
4.4.2	Two trigger channels.....	9
4.5	Octave settings.....	10
4.6	Bandwidth.....	10
4.7	SPL weighting.....	10
4.8	Measurement time.....	10
4.9	History channels and runs.....	10
4.10	Correction methods.....	12
4.10.1	C1 and C2 meteorological correction.....	12
4.10.2	K1 background noise correction.....	12
4.10.3	K2 room correction.....	12
5	Measurement and visualization.....	14
5.1	Example measurement.....	15
6	Offline calculation.....	18
6.1	Placing the cursors.....	19
7	Export.....	20
8	FAQ.....	22
9	Version history.....	23
9.1	Plugin version.....	23
9.2	Documentation version.....	23

1 Installation

1.1 Download



DEWESoft® homepage

<http://www.dewesoft.com>

you can download DEWESoft® plugins when you go to: Support – Downloads – Plugins

1.2 Compatibility

The plugin is compatible with DEWESoft® X1 and X2.

It has been tested on Windows 7 (32-bit and 64-bit).

1.3 Licensing

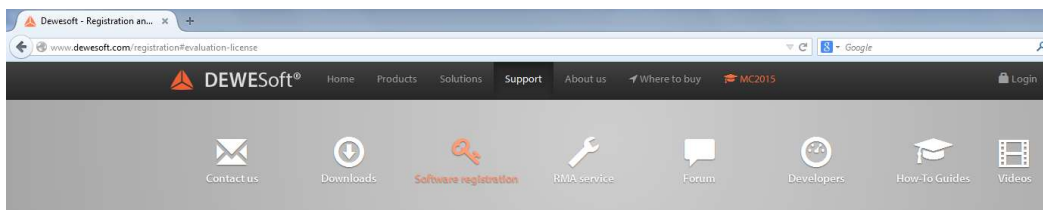
In DEWESoft® an additional license for the plugin is needed, it can also be written into the Dewesoft® device.

The plugin requires a valid DEWESoft® license.

To test the plugin you can use a *30-days-Evaluation license*.

1.3.1 Requesting an evaluation license

You can request an an *Evaluation license* from our homepage: <http://www.dewesoft.com/registration>



Software registration

Online registration

Offline registration

Evaluation license

Evaluation license

To receive a fully functional 30-day evaluation license for Dewesoft software fill and submit the form below. Data marked with * is required. Please provide valid email address where we can send you the evaluation license.

Firstname *

Lastname *

Company *

Country *

Email *

Phone *

Application *

[Request license](#)

Illustration 1: Request Evaluation License

Click on Evaluation license, fill out all the required fields, then click the “Request license” button.

1.3.2 Activating the evaluation license

When you have received your trial licence key, open DEWESoft®, go to Settings → Settings, then select the Licensing tab sheet, click Create new license and enter the license code.

Now enter the license code and click the forward icon to proceed the registration.

Then your new license key will show up in the list and should have the Status Valid.

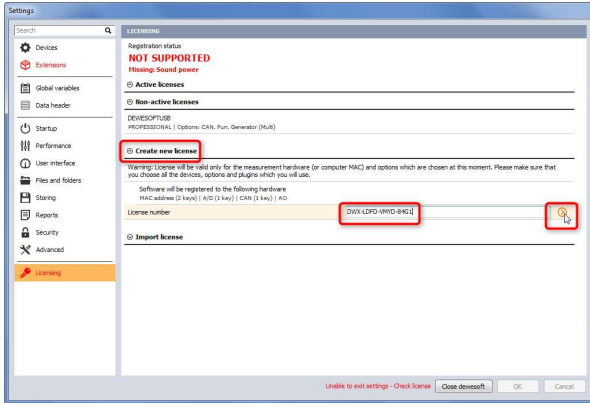


Illustration 2: Enter license key

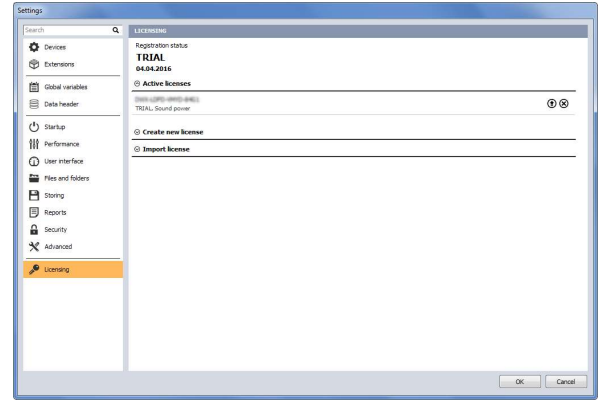


Illustration 3: Valid trial license

1.4 Plug-in installation

The file SoundPower vXX.zip contains the file SoundPower.dll. Please copy the file into the Addons folder of your DEWESoft® installation. (e.g. D:\DEWESoft\Bin\X2\Addons\), then start DEWESoft®. In Settings → Settings → Extensions, click the “+” button and add the plugin, click the checkbox (red boxes in below picture). The plugin will show up in the list.

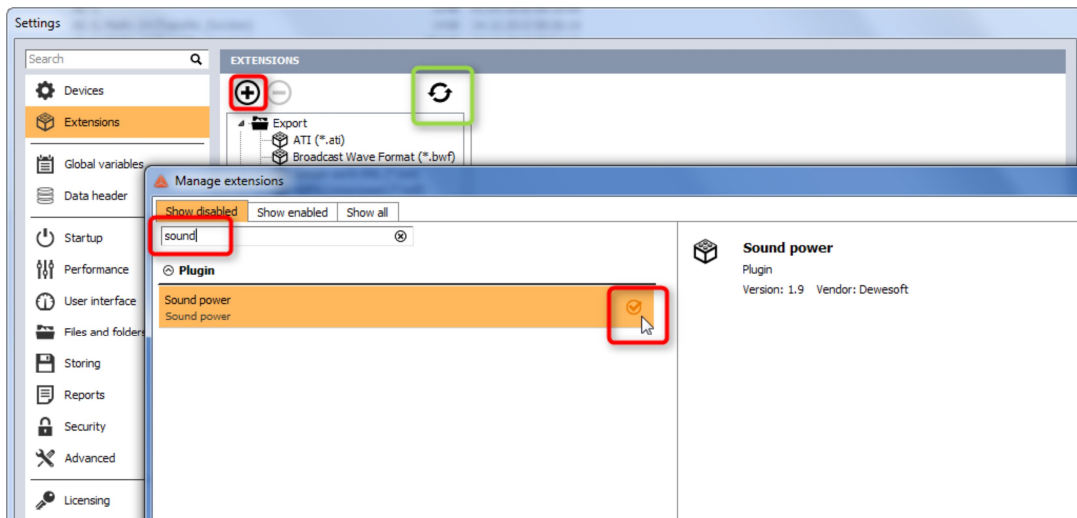



Illustration 4: Plugin in Hardware setup

HINT



If there are no plugins shown at all, you have to click the  button first (green box in picture above). This will add all plugins to the Windows registry (executes the program DCOMReg.exe). First ensure, that you have admin rights on this computer.

2 Introduction

Sound power is a characteristic of the sound source, it is independent of the distance and therefore a practical way of comparing various sound sources. Sound Power can be measured in different ways (by Sound Pressure or by Sound Intensity). The SoundPower-Plugin performs the calculation by measurement of Sound pressure.

Sound Power is calculated by following equation:

$$L_W = \overline{L_P} + 10 * \log_{10} \left(\frac{S}{S_0} \right) - K_1 - K_2 + C_1 + C_2$$

Illustration 5: Sound Power Formula

where:

L_W = Sound Power Level

L_P = Sound Pressure Level

S = Measurement Surface

S_0 = Reference surface (is by standard 1 m²)

K_1 = Background noise correction

K_2 = Room noise correction

C_1 = Meteorological correction

C_2 = Meteorological correction

For example, if we have a free-field measurement, and the microphones are aligned in a sphere, then L_P is the Sound Pressure Level measured by 10 microphones, the surface S is $4\pi r^2$, the background noise K_1 is the noise emitted from the machinery around the sphere, and there is no K_2 because we have free-field. C_1 and C_2 also stay zero, because the outside temperature is around 23°C and the altitude of the test site is below 500 meters sea level.

3 Setup microphones

3.1 Microphone calibration

Connect the microphone(s), then in Channel Setup, select “Sound Pressure” as Physical Quantity, then the following scaling options will appear:

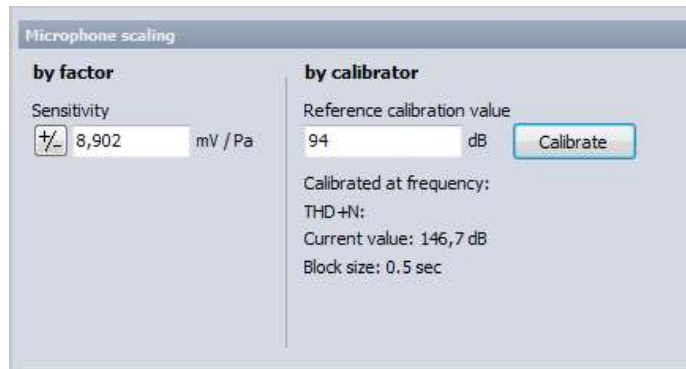


Illustration 6: Calibration options in DEWESoft Channel Setup

To calibrate the microphones there are two options:

▲ by sensitivity factor:

Enter the sensitivity factor from the calibration sheet of the microphone.

▲ by calibrator:

Put the microphone tip into a Sound Calibrator and click the “Calibrate” button; the Sensitivity will be automatically determined and written into the field on the left side.



Illustration 7: Calibration with Sound Calibrator
(1 Pa = 94 dB at 1 kHz)

4 Setup SoundPower

The SoundPower-Plugin Setup can be splitted into following sections:

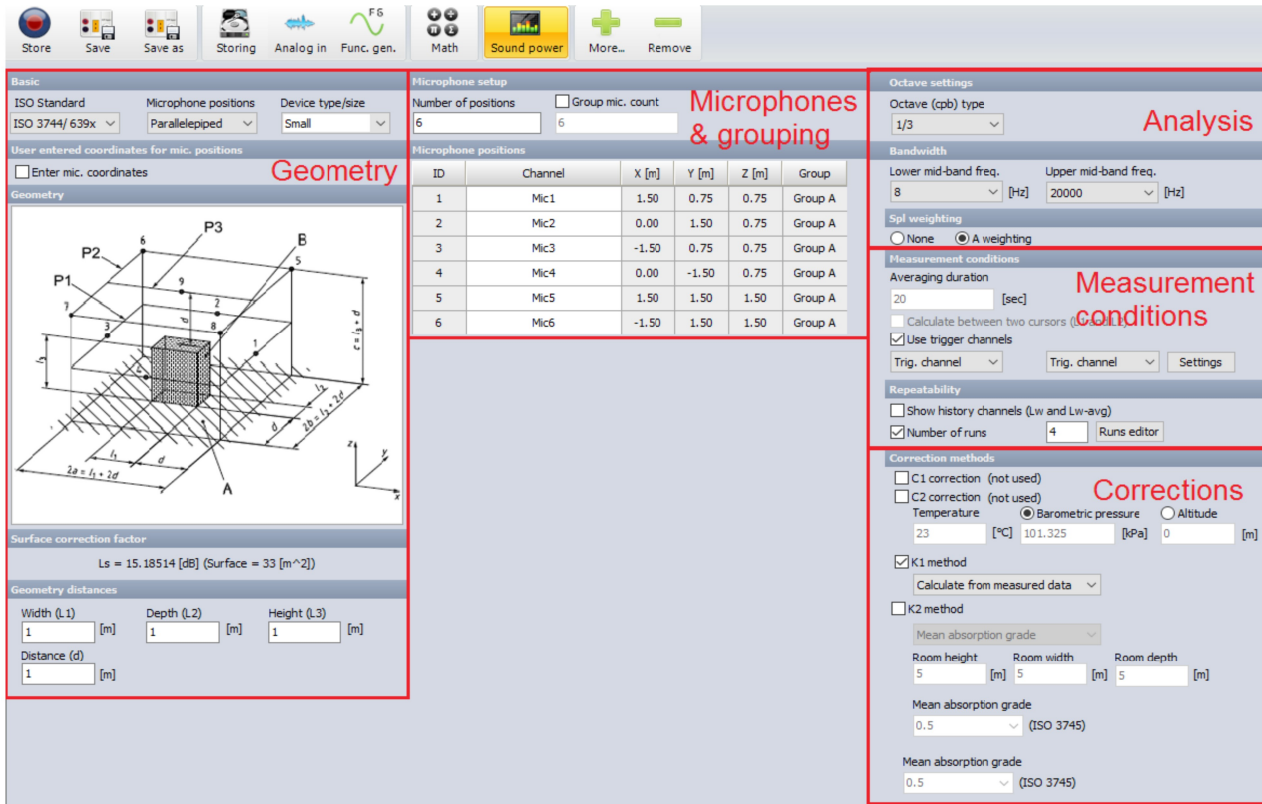


Illustration 8: SoundPower-Plugin Setup

Geometry

Chose according to which standard you are measuring (ISO 3741, ISO 3744, ISO 3745), chose microphone arrangement and distances, as well as details about measurement surfaces.

Microphones & Grouping

As some standards require 20 microphones and more – in order to save costs for equipment – you can align e.g. 5 microphones in a group and then move them through all 4 positions step-by-step during measurement, after that all data is combined automatically.

Measurement conditions

Define the duration of the measurement. The start and the end of the sound power measurement can also be triggered with trigger channels (e.g. light barriers). If you want to measure at multiple modes of operation, use the option Runs.

Analysis

Select CPB resolution as well as bandwidth, frequency weighting and measurement time. It is also possible to change and recalculate these offline after the data file is stored.

Corrections

If you need to apply correction factors, K1 can be determined by background noise measurement, K2 takes care about room correction, C1 and C2 correct deviations due to meteorological reasons (temperature and barometric pressure).

The parameters are described in more detail on the following pages.

4.1 Basic

4.1.1 ISO standards

In the Plugin you can chose between the standards:






-  **ISO 3741**
noise source in reverberation test room
-  **ISO 3744/639x**
free-field over reflective plane (engineering-grade)
-  **ISO 3745**
anechoic or hemi-anechoic room (precision-grade)



Illustration 9: Basic section

4.1.2 Microphone positions

Each standard describes different microphone arrangements:

-  **ISO 3741**: user-definable positions
-  **ISO 3744/639x**: Parallelepiped, Cylindric, Hemisphere

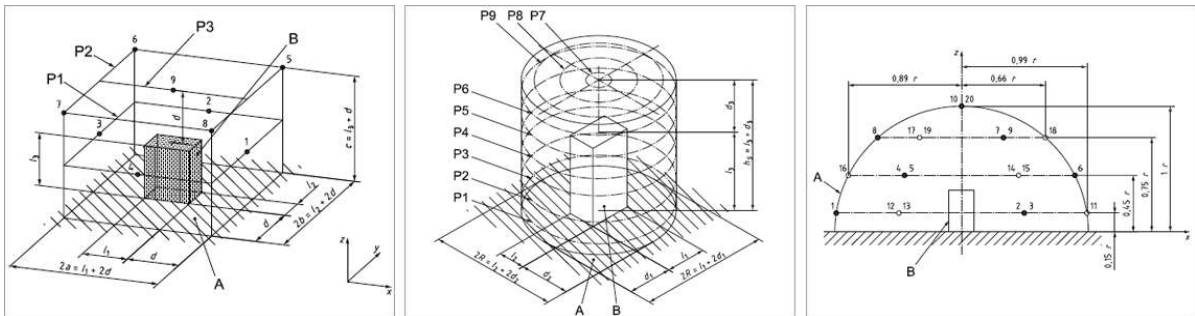


Illustration 10: ISO 3744 microphone positions

-  **ISO 3745**: Hemisphere, Sphere

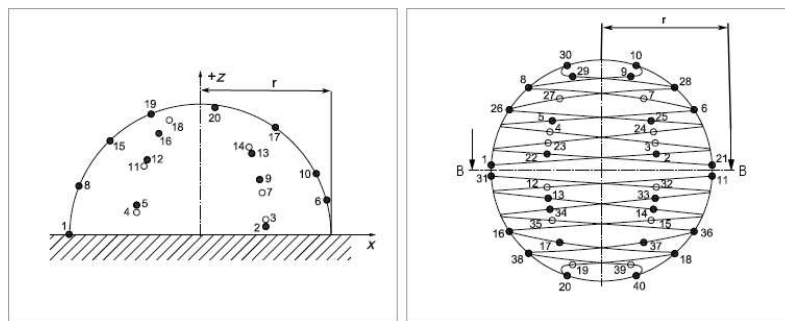


Illustration 11: ISO 3745 microphone positions

4.1.3 Device type/size

The ISO 3744 gives also specification related to the location of the measurement surface.

The device type/size can be “Normal” (only floor), “1 Wall” (floor and 1 wall) or “2 Wall” (floor and 2 walls, which means D.U.T. placed in a corner). All the required microphone positions will be shown. - Parallelepiped in ISO 3744 has besides Wall and Corner also other types/size (Small, Tall, Long, Medium, Large). These types/size have the same equation for measuring surface. The only difference is the number of microphones. That means that you can choose Small type/size and measure Large type/size device but you need to enter the correct value for Number of microphones of Large type/size.

ISO 3741 is applicable to noise sources with a volume not greater than 2 % of the volume of the reverberation test room.

4.1.4 Geometry distances

In order to calculate Sound Power we need the surface of reference box (device). Depending on the microphone positions the parameters change. If you have selected parallelepiped, we have L1, L2, L3 which represents width, depth, length of the measured device and D, which is distance between device and measured surface.

In case you have selected Sphere or Hemisphere in standard ISO 3745 or Hemisphere in ISO 3744 you need to insert the radius of the measurement surface.

If you selected Microphone positions Cylinder then you need to insert values L1, L2, L3 which represents width, depth, length of measured device and D1, D2, D3, which are width, depth and length distances between device and measurement surface.

ISO 3741 does not require geometry parameters.

Geometry distances		
Width (L1)	Depth (L2)	Height (L3)
1 [m]	1 [m]	1 [m]
Distance (d)		
1 [m]		

Illustration 12: Geometry parameters

4.2 Microphone setup

ISO 3744 and ISO 3745 also specify the number of microphones, depending on the geometry setup chosen.

Per ISO 3741 you should use at least 6 microphones and can work with user-definable positions. The minimum distance between source and nearest microphone must therefore be at least 1,03m below 5000 Hz and 0,516 over 5000 Hz.

If the number of microphones differs from the standard, you will get a warning but you can continue. If you have less physical microphones than microphone locations, you can align them in groups and move through them step-by-step during measurement (e.g. rotate them through four positions in cylindric arrangement). At the end all data will be combined.

4.3 Microphone positions

In the “Microphone positions” section you can assign the analog channels to the positions, just click on the text fields and select from the dropdown menu. The X, Y, Z coordinates of microphones, as well as the groups are shown.

In case the number of microphones is bigger than maximum in standard ISO 3744 or ISO 3745, then the coordinates will become zero.

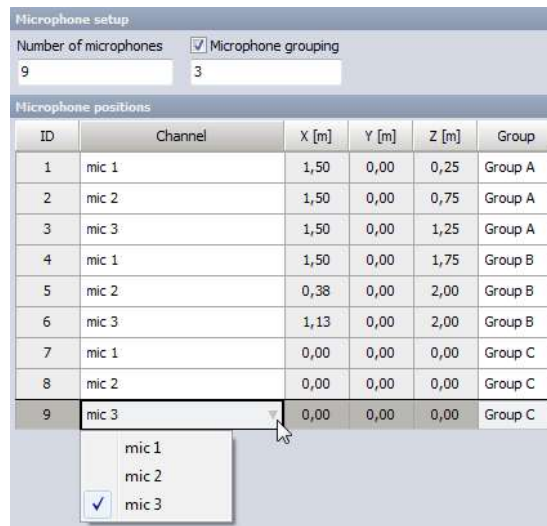


Illustration 13: Microphone positions and grouping

4.4 Triggers

The start and the end of the sound power measurement can be triggered with trigger channels (e.g. light barriers). Check the Use triggers checkbox and select the first and second trigger channels from the drop-down menu. Trigger channels can be synchronous, asynchronous or single value channels.



Illustration 14: Trigger channels

When you enter the Settings, you can define the trigger edge direction (positive or negative) and the trigger level (by default, trigger level is set to 0.9 and retrigger level is set to 0.1).

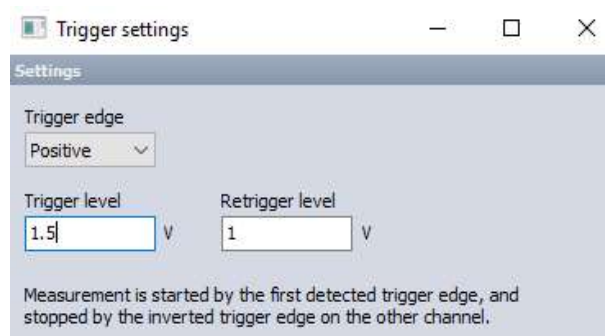


Illustration 15: Trigger level settings

The measurement is started by the first detected trigger edge and is stopped by the inverted trigger edge on the other channel.

4.4.1 One trigger channel

If the same channel is selected as the start and stop channel, the measurement is started by the first detected edge on the trigger channel and is stopped by the retrigger edge on the same channel.

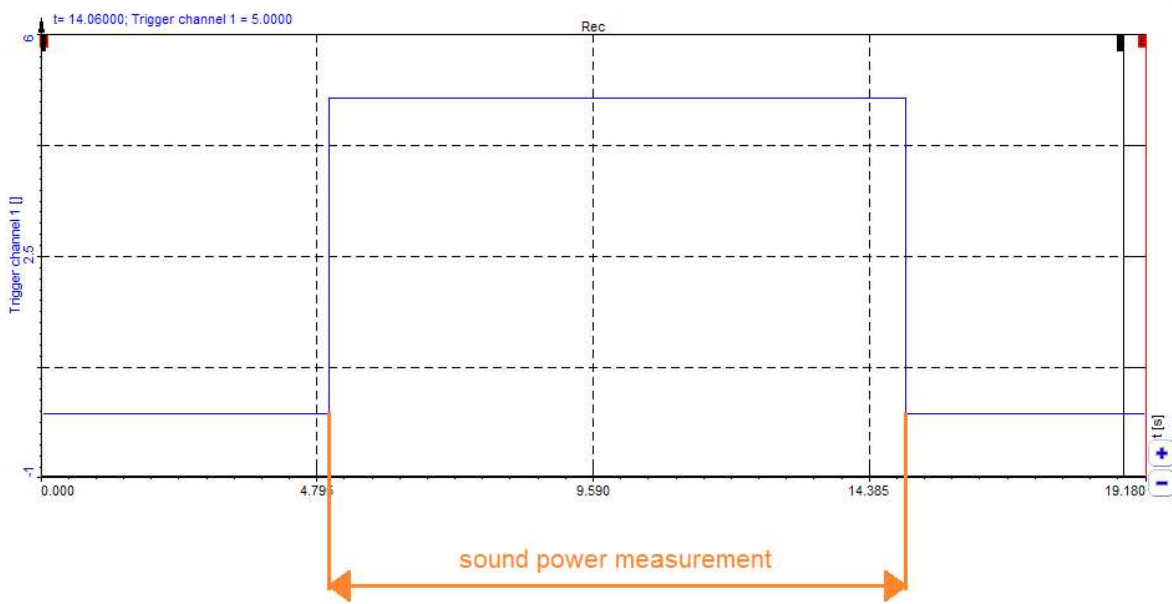


Illustration 16: One trigger channel

4.4.2 Two trigger channels

If one channel is selected as the start channel and one channel is selected as the stop channel, the measurement is started by the first trigger edge on the first channel and is stopped by the inverted trigger edge on the second channel.

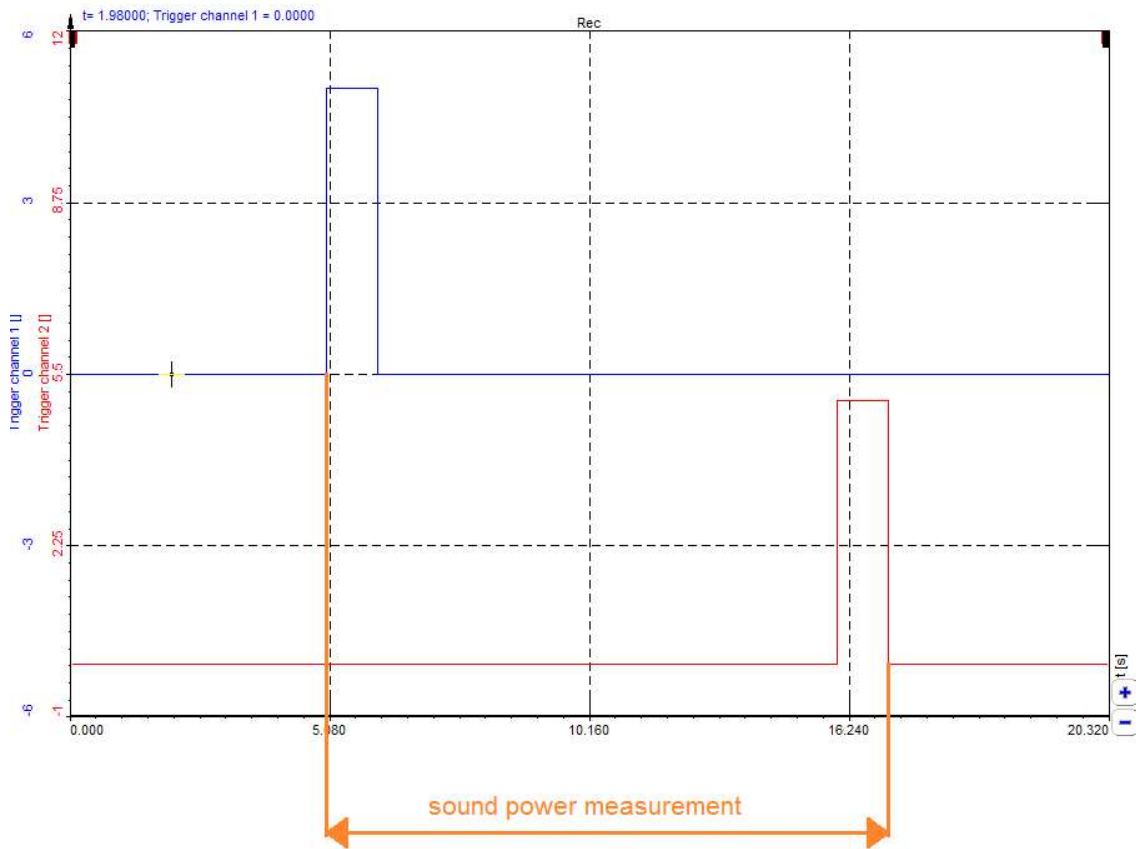


Illustration 17: Two trigger channels

4.5 Octave settings

For the frequency analysis usually the Constant Percentage Bandwidth (CPB) is used. You can choose between 1/1 or 1/3 octave type.

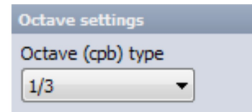


Illustration 18: Octave settings

4.6 Bandwidth

In the Bandwidth section you can choose the frequency band for the calculation. Values are chosen from the drop-down menu. They depend on (and will change with) the selected acquisition rate.

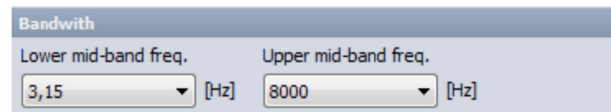


Illustration 19: Bandwidth settings

4.7 SPL weighting

Because the human hearing is non-linear, it is required to apply frequency-weighting. The plugin supports type A weighting and no weighting.

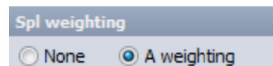


Illustration 20: Sound pressure level weighting

4.8 Measurement time

Measurement time affects the certainty of the measurement. ISO 3741, 3744 and ISO 3745 recommend that the measurement time should not be less than 10 seconds and should be more than 20 seconds.

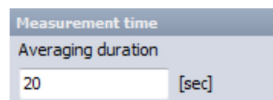


Illustration 21: Measurement time

4.9 History channels and runs

Select the number of runs (e.g. number of operation modes of the machine) you want to measure sound power level and sound pressure level.

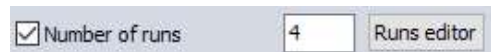


Illustration 22: Defining the number of runs

During the measurement easily select the run from the drop-down menu.



Illustration 23: Drop-down menu for the runs during the measurement

If you want to change the name of the runs, enter the Runs editor in the setup.

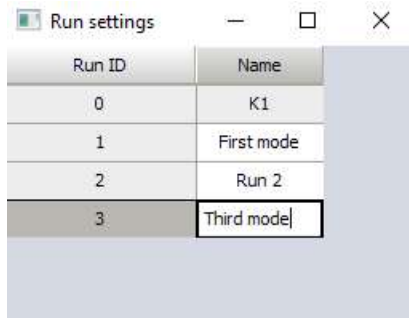


Illustration 24: Defining the name of the runs

Time	Lw history dBA	Run ID
37.34000	118.3893	Third mode
27.34000	117.0018	Second mode
17.34000	115.3718	First mode

Illustration 25: Lw history of runs and run ID

In the exported matrix of results you can display the results for each microphone and for each run.

	A	B	C	D	E	F
1 Results Matrix	dBA					
2 Mic/Run	First mode	Second mode	Third mode	Avg.	K1 (Spl)	
3 Mic. 1	100.55452	102.07919	103.39577	102.16243	89.474136	
4 Mic. 2	100.53933	102.03765	103.38631	102.14119	89.387657	
5 Mic. 3	100.53943	102.06599	103.37711	102.14638	89.449532	
6 Mic. 4	100.48953	102.04311	103.36516	102.12215	89.365288	
7 Mic. 5	100.54063	102.07155	103.38702	102.15286	89.436813	
8 Mic. 6	100.55885	102.06483	103.38413	102.15359	89.472183	
9 SPL	100.5371	102.06041	103.38259	102.14645	0	
10 Lw	115.37183	117.00178	118.38928	117.09274	0	
11 Time	4.6199994	4.6199994	4.6199994	0	4.6199994	

Illustration 26: Exported matrix of results

4.10 Correction methods

4.10.1 C1 and C2 meteorological correction

C1 and C2 meteorological corrections are used in the case that the air temperature at the test site is below 23°C or the altitude is higher than 500 meters above sea level. When you activate the option, it will be immediately calculated and written next to the label. You can either enter barometric pressure or altitude, the other value will be calculated automatically.

4.10.2 K1 background noise correction

K1 is by standard defined as the background noise correction. This is applied in different situations, please refer to the standard. K1 can be measured before switching on the sound source, or afterwards calculated by correctly placing the cursors on the measured data.

4.10.3 K2 room correction

K2 corrects the influence of the room noise. Three methods are implemented in the SoundPower plugin.



Mean absorption grade:

Please enter the room size and the mean absorption grade according to the standard



Reverberation time:

These parameters can be determined by acoustic measurement.



Enter values:

An editor is provided, click first “Create K2 table”. Please ensure you have selected the correct bandwidth first, otherwise the table will be reconfigured when changing bandwidth and values would get lost. The entered values in the table will be saved to the DEWESoft® setup.

The screenshot shows a dialog box titled "Correction methods". It contains the following elements:

- Two unchecked checkboxes: "C1 correction (not used)" and "C2 correction (not used)".
- Temperature: 23 [°C]
- Barometric pressure: 101.325 [kPa] (selected with a radio button)
- Altitude: 0 [m] (unselected with a radio button)
- Checked checkbox: "K1 method" with a dropdown menu set to "Calculate from measured data".
- Checked checkbox: "K2 method" with a dropdown menu set to "Mean absorption grade".
- Room height: 5 [m]
- Room width: 5 [m]
- Room depth: 5 [m]
- Mean absorption grade: 0.5 [ISO 3745]

Illustration 27: Correction methods

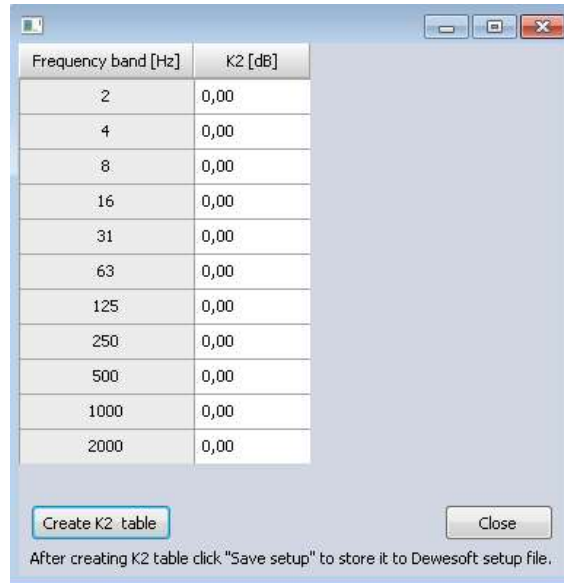


Illustration 28: Editor for K2 values

HINT



For ISO 3741 the corrections C1, C2 and K2 are obligatory, and therefore it is not possible to deselect them (locked).

5 Measurement and visualization

When you go to Measure mode, there is an auto-generated display called “SoundPower”. At first all the graphs are empty.

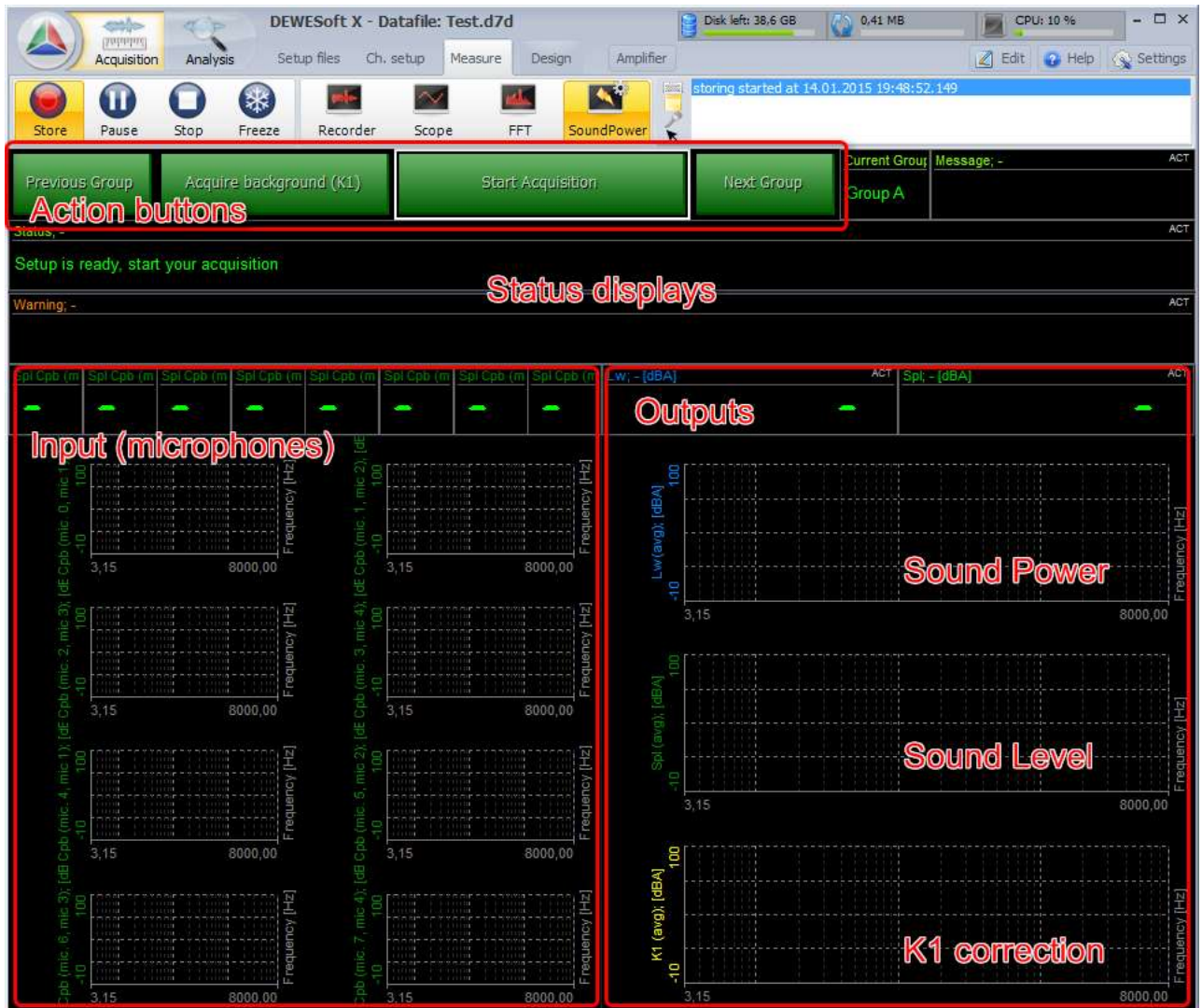


Illustration 29: Auto-generated SoundPower screen

- ▶ Action buttons are provided on top to enable the user to go through the different steps of acquiring background noise and then start the real measurement, as well as switching between microphone groups.
- ▶ The Message, Status and Warning displays show the progress (e.g. “17,2 / 20 sec done”; “K1 background acquiring...”) and warnings if certain conditions are not fulfilled (e.g. “Acquisition finished early.”...).
- ▶ On the left side the input signals are shown: overall sound pressure levels of the microphones in the digital meters and CPB plots below.
- ▶ On the right side the output signal show SoundPower and Overall Sound Pressure of all microphones in the digital meters, and the CPB plots of SoundPower, SoundLevel and corrections.

On the next pages an example measurement is shown to explain the order of the steps to be done.

5.1 Example measurement

For this example 4 microphones are used and aligned in 2 groups, which means the setup has to be changed once between. The measurement time stayed at 20 sec, which is the default value.

Microphone setup						
Number of microphones		<input checked="" type="checkbox"/> Microphone grouping				
8		4				
Microphone positions						
ID	Channel	X [m]	Y [m]	Z [m]	Group	
1	mic 1	1,50	0,75	0,75	Group A	
2	mic 2	0,00	1,50	0,75	Group A	
3	mic 3	-1,50	0,75	0,75	Group A	
4	mic 4	0,00	-1,50	0,75	Group A	
5	mic 1	1,50	1,50	1,50	Group B	
6	mic 2	-1,50	1,50	1,50	Group B	
7	mic 3	-1,50	-1,50	1,50	Group B	
8	mic 4	1,50	-1,50	1,50	Group B	

Illustration 30: Example microphone setup

The flowchart for the following example looks like below. With the “previous” and “next” buttons you can switch between the groups and also repeat a measurement, as long as not all the data is acquired.

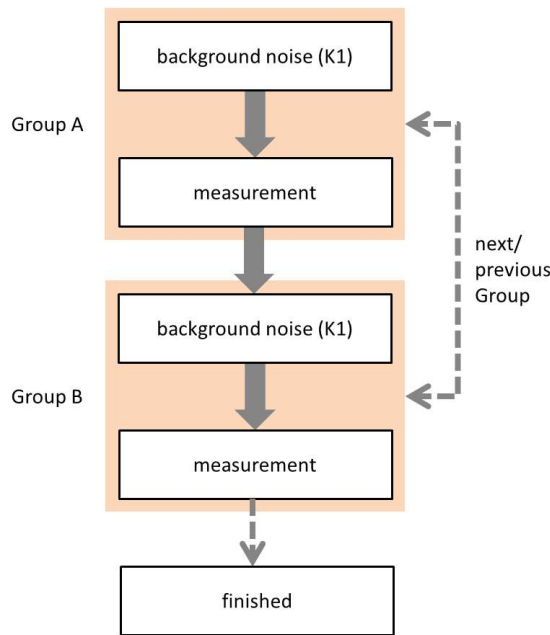


Illustration 31: Example measurement process

1. Start storing (sound source is switched off!); next to the four buttons you see that “Group A” is active.

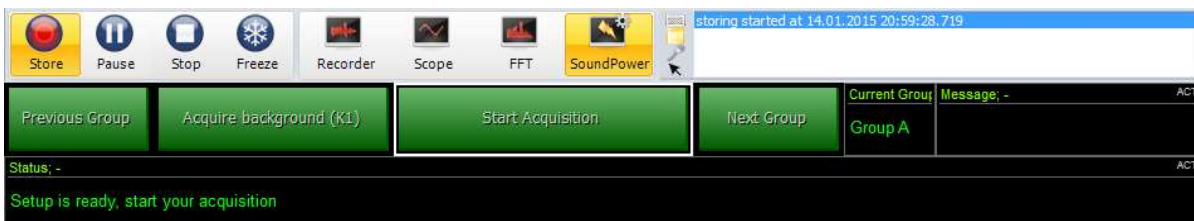


Illustration 32: Ready for acquisition

- Then click “Acquire background (K1)”, wait for 20 sec, progress is shown in the status display.

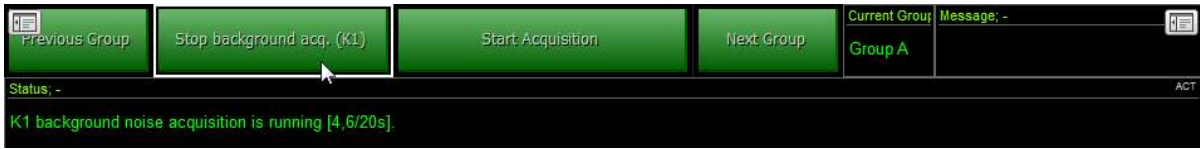


Illustration 33: Group A: K1 measurement

- After K1 Acquisition is finished, switch on the sound source.
- Click “Start Acquisition”, wait again 20 sec. The four microphone CPB plots (Group A) below should fill with data.



Illustration 34: Group A: Measurement

- After acquisition is done, switch off the sound source.
- Change the microphone setup. The four microphones should move to their second position.
- Then change to “Next Group”. Display on the right will show “Group B”.

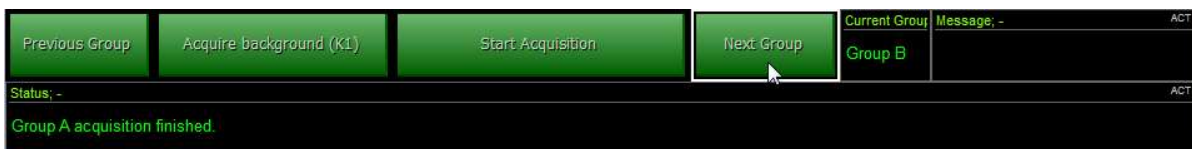


Illustration 35: Change setup, switch to next group

- Click “Acquire background (K1)”, wait 20 sec. Sound source must stay switched off. As the microphone positions changed, we have to repeat the K1 measurement for this position.

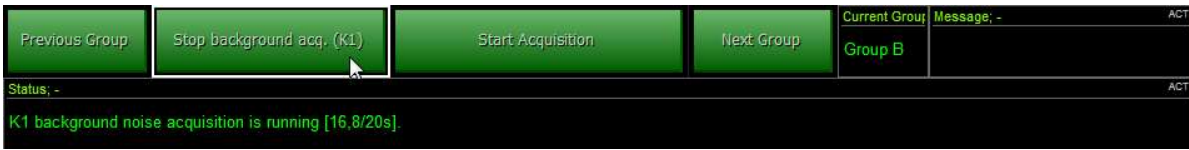


Illustration 36: Group B: K1 measurement

- Now switch on the sound source again.
- We click “Start Acquisition” and wait 20 sec. After that, also the other four displays on the left side (Group B) should fill with data.
- At the end the text “Sound power measurement finished” should be shown. The display below gives more details if something went wrong (Warning). The CPB displays on the right side show SoundPower, SoundLevel and K1 factor result.



Illustration 37: Measurement finished

6 Offline calculation

The SoundPower Plugin also supports offline calculation, that means changes in calculations can be done on the measured data (changing of microphone groups however is not possible).

It's even possible to only collect raw data at the test site and perform all calculations afterwards in the office. Therefore one should be aware to have enough data, for the standard 20s noise and 20s with sound source switched on. Below you see an example with the minimum data (here with 3 microphones):

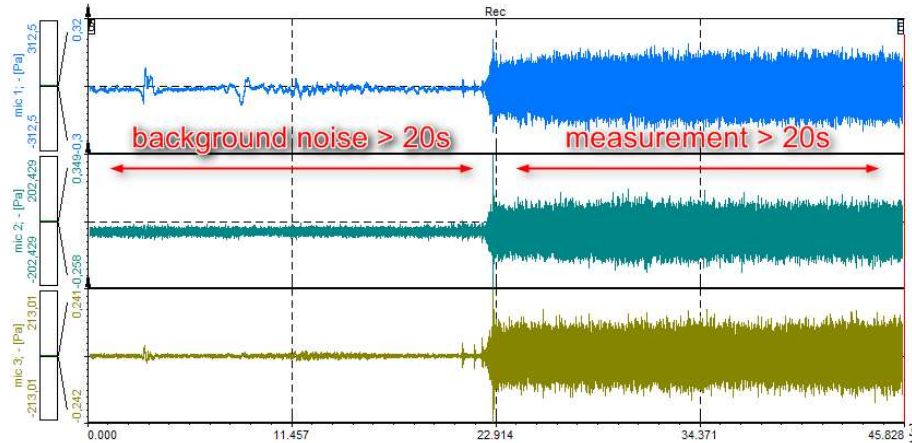


Illustration 38: Datafile containing only raw data of 3 microphones

In Analysis mode, when the datafile is open, go to Offline math...

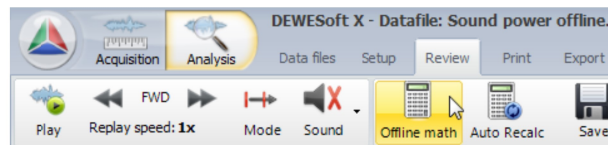


Illustration 39: Offline math

... and add the SoundPower module. Do all the settings, ...

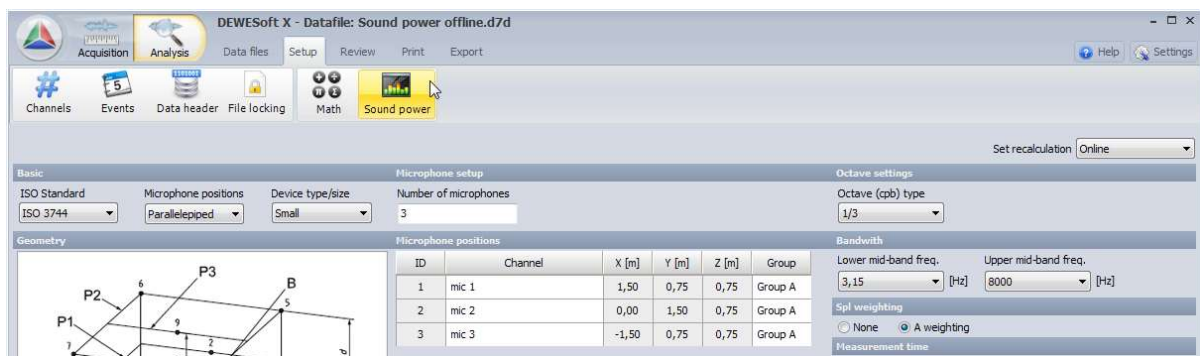


Illustration 40: Add SoundPower module offline

... then return with "Review" and do "Recalculate".



Illustration 41: Recalculate

Probably the calculation did not work yet, and you got a warning if you were using K1 correction. Please see next chapter how to place the cursors.

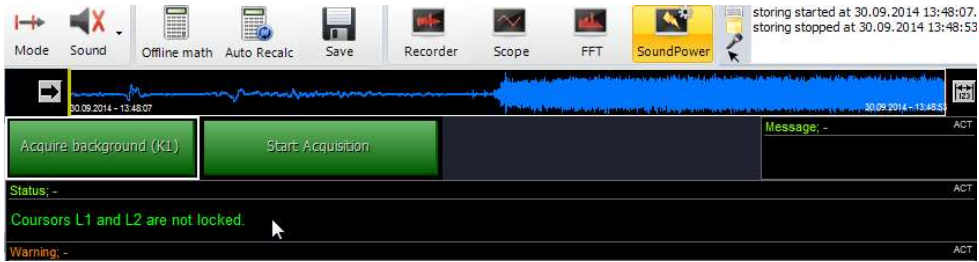


Illustration 42: Cursors not locked - Warning

6.1 Placing the cursors

We need to provide the plugin the information where is the background noise, and where to look for the sound source data. Position the white Cursor I at the start of the background noise and Cursor II at the start of the sound.

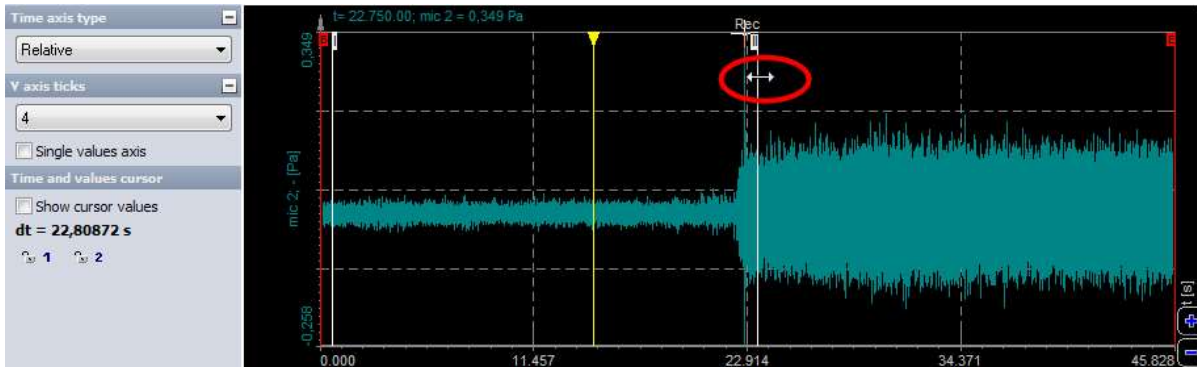


Illustration 43: Position the cursors

Then click on the cursor symbols to the left. The cursors change to green color, indicating they are locked now.

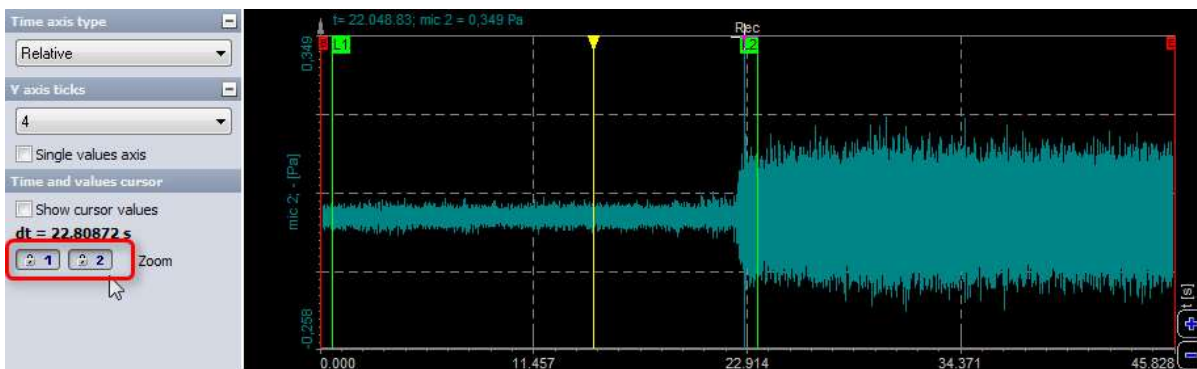


Illustration 44: Lock the cursors

Recalculate again, now the calculation is performed.

HINT



You can also perform the c on only one specific part of the data. Use the recorder instrument and zoom into the interesting area.

7 Export

When the calculations are finished, there are multiple options how to export the data out of DEWESoft®. We can either print the current display arrangement or export to clipboard or to external software.

For the first option just click on the button “Print”, and select the printer, which can also be a PDF.

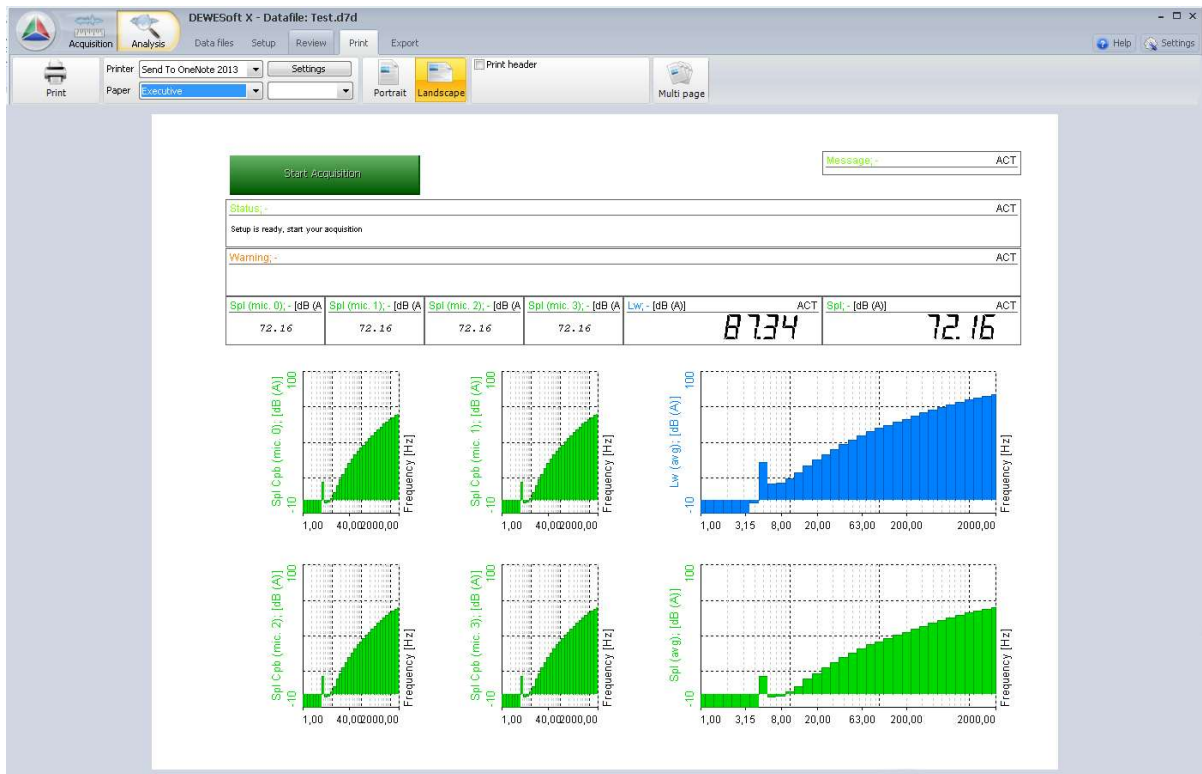


Illustration 45: Print current screen

A quick way to export the data is by using the clipboard. Click on the instrument, e.g. the Octave plot showing the K1 correction data, to set it active. Then select “Copy data to clipboard” from the Edit menu.

Start Excel and paste the data into, the columns and rows will be filled exactly with the data you see.

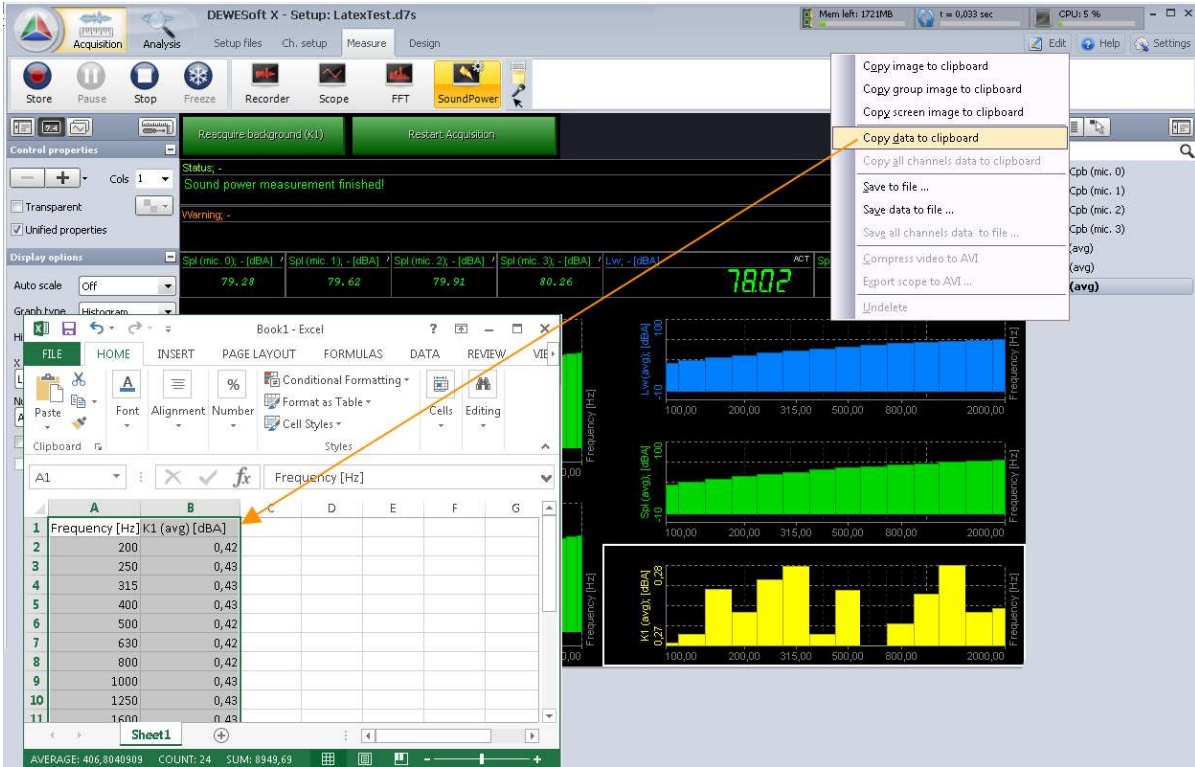


Illustration 46: Print current screen

Or use the default export into a lot of different file formats, such as Matlab, Excel, Diadem, RPCIII, CSV, etc..

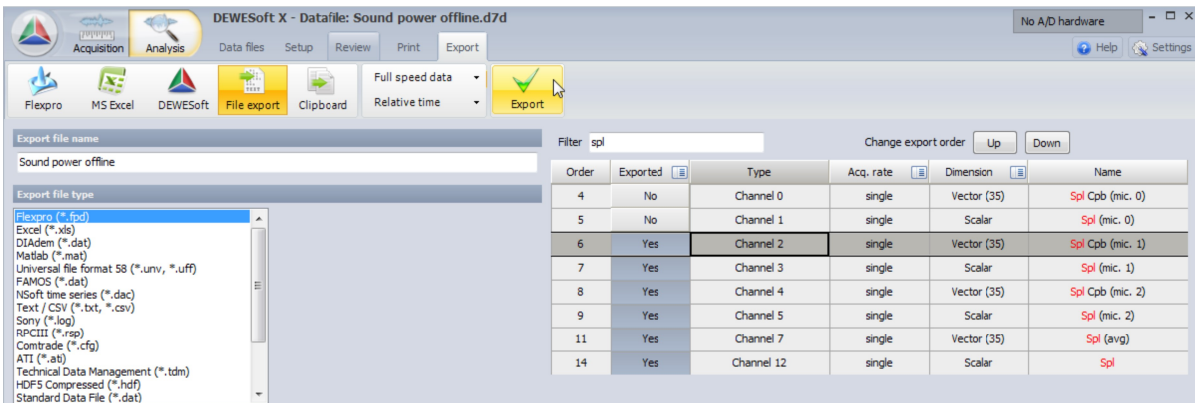
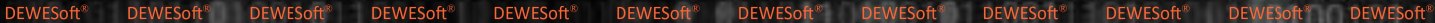
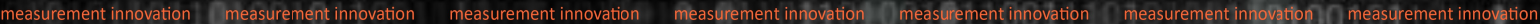


Illustration 47: Export formats



8 FAQ

This section should help to find quick solutions for known problems.



9 Version history

9.1 Plugin version

Plugin-Version	Date [dd.mm.yyyy]	Notes
1.1	03/12/14	Initial version
1.2	17.01.15	
1.3	03.02.15	
1.4	22.04.15	
1.5	03.07.15	
1.6	17.07.15	
1.7	01.09.15	
1.8		
1.9	17.02.16	Added ISO 3741 standard
3.0	27.03.17	Added standard 639x, triggers and runs, K1 factor can be added as a table

9.2 Documentation version

Revision number: 79

Last modified: Tue 28 Mar 2017, 08:11

Doc-Version	Date [dd.mm.yyyy]	Notes
1.0	26/09/14	initial revision for plugin version 1.1
1.1	15/01/15	Dewesoft® manual template, structural rework
1.2	07.09.15	4.1.1 ISO standards: ISO3744/ISO3745, free field/anechoic, was exchanged
1.3	15.09.15	4.1.1 ISO standards: typo: should be hemi-anechoic instead of semi-anechoic
1.4	10.03.15	Added ISO 3741 standard renewed screenshots for licensing for X2
1.5	28.3.17	Added triggers, runs description. Renewed screenshots for current GUI