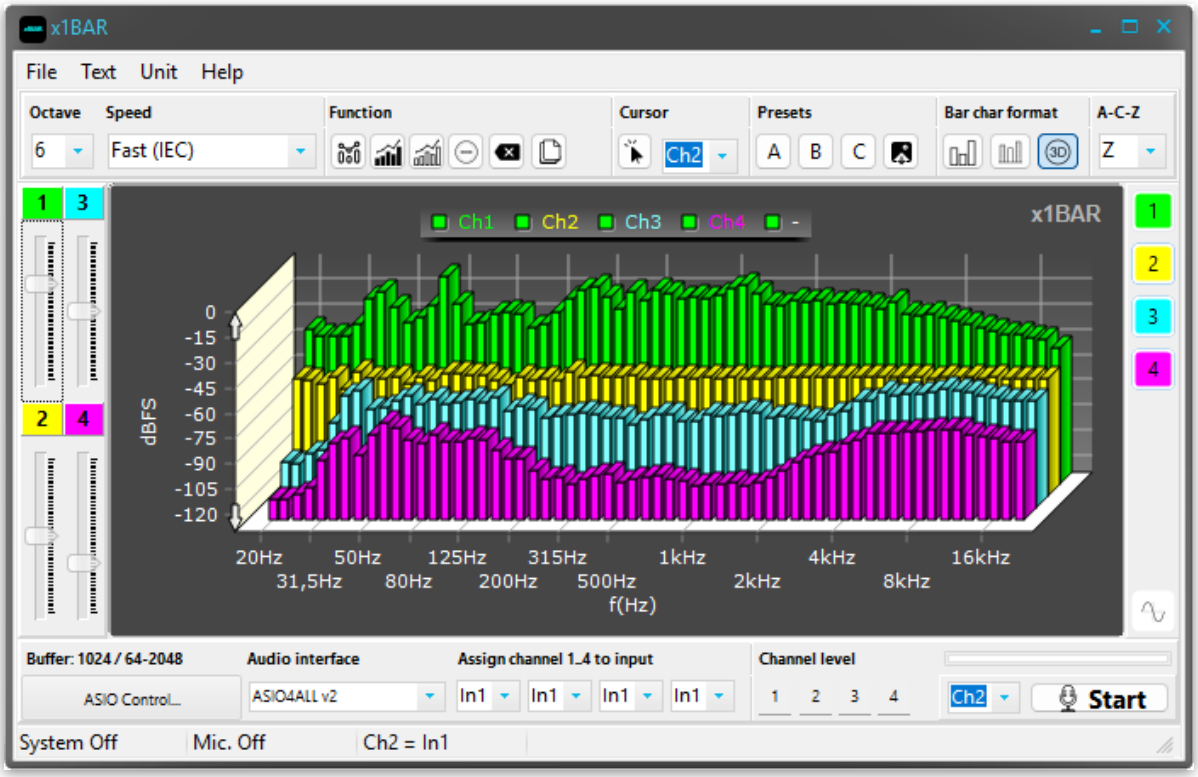


x1BAR

10 Channel Input & 4 Bars 3D Real Time Analyzer

1. Introduction

1.1. Application Area

With x1BAR you get a modern and powerful acoustic analyser software. Application areas are evaluation of car, HiFi, PA, and home cinema sound systems or measurement of the sound emission of machines or devices.

1.2. RTA vs. FFT?

RTA octave band measurements may initially seem coarse compared to an FFT. However, this reduced resolution is actually an advantage in many practical applications. The crucial point: octave bands are aligned with the frequency-dependent resolution of human hearing and also comply with common technical standards. As a result, they provide a more interpretable and practical representation than a high-resolution FFT.

1.3. Which Hardware is required?

x1BAR is a hardware-open system. Commercial available USB audio interface and suitable measurement microphones can be used for measurements. x1BAR supports multi-channel sound cards with up to ten inputs, enabling measurement series to be carried out quickly on different microphone positions. For room acoustic measurements, a sound source – such as an active speaker or a loudspeaker with an amplifier – is also required. The sound source should have a sound pattern as close as possible to omnidirectional.

1.4. Software installation

You can download both the free demo version and the full version from our website.

To start installation download the setup file to your PC. Then run the installation with administrator rights (right-click on the file in File Explorer). Once the installation is complete, you will find the icon on your desktop.

2. Overview moduls

2.1. Module RTA (Octave-band measurement)

- Comfortable 4-channel measurement display
- Up to 10 microphones for direct access
- Sound profiles (reference curves) for tuning car audio systems
- IEC 61260 centre frequencies, Class 1 filter slope
- Rise time constants: Impulse, Fast and Slow
- A-C-Z frequency weighting
- Audio interface calibration
- Microphone correction (0°, 90°) per interface input
- Graphical view Peak, Peak & Decay, Difference, Snapshot
- Text input for display channel
- Archiving: Save, export, print

2.2. Module Generator

- Tool for RTA measurements
- Signals: Log. Sweep & Pink Noise

2.3. Module Copy&Paste Manager

With the Copy&Paste Manager, measurements from the display channels in the RTA module can be temporarily stored and reinserted. This applies to individual display channels or all 4 channels. 3 memory banks with 4 channels each are available.

3. Please note

- Please pay close attention to the following warnings:
- Mute or turn off the amplifier when connecting the audio interface to the amplifier.
- Perform initial playback tests of the test signal at low volume.
- Only use test signals that will not damage your speakers, amplifier, or your hearing.
- If a clearly audible measurement signal produces no measurement display, please check the measurement chain, e.g. correct audio interface input selected, sound card gain set to 0, etc.
- Avoid feedback: Some audio interface have a monitoring function that routes the microphone signal directly back to the output. Disable the monitoring function or set the monitor control so that no feedback occurs, e.g., during playback or in the DAW. Details can be found in your audio interface manual.
- Set the MS Windows sound scheme to ‘No sounds’ (avoid system sounds).
- You use x1BAR at your own risk.

4. First Steps

4.1. Preparation

- Install the ASIO drivers for your audio interface. Alternatively, you can use the free ASIO4ALL drivers.
- Connect the audio interface to your PC.

- Install the x1BAR software via the setup file with administrator rights.
- Open x1BAR. You can find the icon on your PC desktop.
- Select the audio interface from the bottom tool bar.
- Check the ASIO buffer setting (default 1024): Open the control window via the “ASIO Settings” button. Set the buffer size to 1024.
- x1BAR supports audio interfaces with up to 10 inputs. These can be assigned to one of the 4 display channels (Ch) in the RTA module (multiple assignments of the same input to a display channel are allowed). Assign the display channels (Ch) to the interface inputs, e.g., Ch1 to Input 1 and Ch2 to Input 2, etc.

4.2. Calibrating the audio interface

x1BAR detects and corrects frequency response deviations of the audio interface. This requires a loop between output and input. Connect the first/left input of the interface to an output or headphone output. Set the gain knobs for the inputs, if available, to 50%. Set the gain knob of the output or headphones to 50%.

Steps:

- Open the setup via the menu in the header: “File / Setup”
- Select the “System Cal.” tab
- Press the “Level?” button under 1)
  - The level indicator to the right of the button must end with a green bar in the middle
  - Signal ok: A message confirms signal ok
  - Signal not ok:
    - Level indicator shows red on the left => move the level knob to the right OR
    - Level indicator shows red to the right of green => move the knob to the left
    - In both cases, adjust the level until the message “ok” appears. If necessary, adjust the output levels on the audio interface.
    - Additional signal check: The RTA bar graph shows a 1 kHz signal.
- After the “Signal ok” message, start hardware calibration. Press the “Start” button under 2).
- Wait for the “Calibration complete” message
- Finally, under 3), select “Use Calibration”
- Exit the setup window with “Save”
- The audio interface calibration is complete.

Tip: Microphone correction for free-field & diffuse-sound as well as SPL level settings can be found in the “Setup” chapter.

Illustration: Connection between output and input 1. Output opportunities: either blue (rear outputs) or red (headphones).

4.3. Measuring with an audio interface (Brief Version)

Tip: A detailed guide can be found in the “Measurement Procedures” chapter.

Connect the measurement microphone to an input of the audio interface. If your microphone operates with +48V phantom power, switch on the power on the interface. Initially set the gain knob at the audio interface input to 50%. Note: Use the XLR connector for the microphone when using +48V.

For measurements with test signals from the x1BAR signal generator, you must connect at least one output or the headphone output of the audio interface to an input (e.g. of the active loudspeaker box or the amplifier with speaker). Initially set the output gain knobs from audio interface to low gains for first tests.

x1BAR can now perform RTA measurements with and without test signals.

5. Overview

5.1. Terms

- Popup Menu: A popup menu, also called a context menu (right-click menu), is a graphical control element that displays application-specific functions and actions in a popup window based on the selected object. It allows quick access to functions. You open it with a right mouse click over the mentioned control element.
- Channel: Refers to one of the 4 display channels in the RTA module and should not be confused with the inputs (Inputs In1..10) of the audio interface.

5.1.1. Zoom in charts via mouse gestures

- Zoom in: Drag a rectangle from left to right with the mouse over the area to be enlarged
- Zoom out: Drag a rectangle from bottom right to top left

5.2. Module RTA

5.2.1. Main menu

Menu File (1)

Open	Open a saved measurement

Save	Save measurement
PDF Export	Export chart as PDF file
Load Sound Profile Ch1 (reference chart)	Select the sound profile from a file, e.g., SUV vehicle. The target curve is loaded into display channel 1 (green). Now perform the measurement in vehicle display channel 2 (yellow). Use the EQ/Audio DSP to match the measurement curve in channel 2 to the target curve. *Tip: Use the offset controls in the left toolbar to adjust the level of the measurement curve and target curve at 1 kHz. For more information on the procedure, see "Work with Sound Profiles"*
Save as Sound Profile (Ch1)	Save the measurement from display channel 1 (Ch1) as a sound profile. Pre-conditions: • Set the RTA octave to "3" • Set "Speed" to "Slow IEC" • Perform the measurement using pink noise. For more information, see "Working with sound profiles".
Print	Print chart
Clipboard	Copy chart to clipboard
Setup	Open program configuration
Quit	Close program

Menu Text

Ch1	Text entry for display channel 1. The text appears in the caption of the bar chart (4)
Ch2..Ch4	Same as channel Ch1 for channel 2,3,4
Std	Set channel text to default value (Ch1, Ch2,..)

Menu Unit

dBFS	The y-axis is scaled in dBFS as the RMS value. For a sine wave with a peak value of 100% of the maximum input voltage, the RMS value shown is -3 dBFS
dBFS RMS	The y-axis is scaled in dBFS as the root-mean-square (RMS) value. For a sine wave signal with an RMS value of 100% of the maximum input voltage, the displayed RMS value is 0 dBFS.
SPL dB	SPL correct scaling of the y-axis in dB when the microphone was calibrated during setup using a 94 dB calibrator. *Important: Once the audio interface's gain has been calibrated, it must not be adjusted again to ensure accurate SPL measurements!*
Peak Hold	This function affects the peak value display in the bottom right-hand corner of the bar graph. Enabled: The highest peak value is recorded. Disabled: The peak value shows the current peak value of the measurement signal.

Menu Help

Help (Web)	Displays the latest version of this manual from the Internet.
Info	Displays the program version and the software installation ID.

5.2.2. Top toolbar

Toolbar top (2)

Octave (a)	Toggles the x-resolution (1/n octave)
Speed (b)	Time weighting: Impulse, Fast, Slow
Functions (c), icons from left to right	• Snapshot : Capture current measurement • Peak + Decay : Peak value with delayed decay • Peak : Absolute peak value • Difference : Subtract: Ch1-Ch2, Ch2-Ch3, Ch3-Ch4, Ch4-Ch1. **Select using the cursor selection (d): Ch1 => Sub Ch1-Ch2, Ch2= Ch2-Ch3…** • Hide : Hides the 5th channel • Apply : Copies the values of the 5th channel to the currently selected display channel, see function bar (5) *Note: The functions are displayed in a 5th display channel (shown in red). The functions appears for the selected channel from Cursor field (d); see below*
Cursor (d)	• Button : Turn cursor on/off • Channel selection : Display cursor for selected channel. Cursor readings appear on the left side of the footer of the bar graph (4). The channel is also relevant for the functions listed under (c), such as Peak or Difference ***Important: The channel is also relevant for the functions listed under c), such as Peak or Difference (determines which channels are subtracted)***
Copy&Paste (e)	• A, B, C : Copy current measurement values from channels 1 to 4 to memory block A, B, or C • Button : Open the Copy&Paste Manager *Note: The Copy&Paste Manager allows you to insert temporarily stored measurements into the bar graph (4). You can copy 1 to 4 display channels. Select the block, then source channel (stored measurement) and the destination channel in the bar graph.*
View (f), icons from left to right	Format of the bar chart (4) • Default: Overlapping bar view, display channel 4 is in front • Offset: Bars for each channel are slightly offset. Measurements for each bar can be easily compared • 3D: 3D view. Good for comparisons; enable “Channel Transparency” (see pop-up menu)
A-C-Z Frequency weighting	• Z : Linear, no weighting • A : Weighting with A-filter • C : Weighting with C-filter

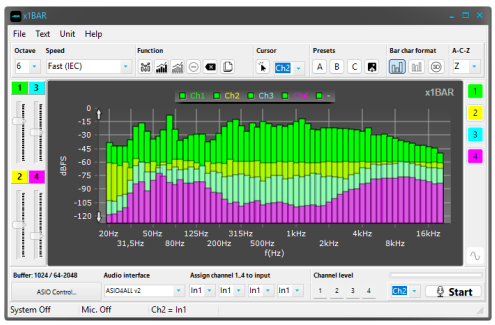
5.2.3. Right toolbar

Toolbar right (3), icons top down

Button 1,2,3,4	Show or hide the display channel x from the bar chart (4). Pressed = Hide

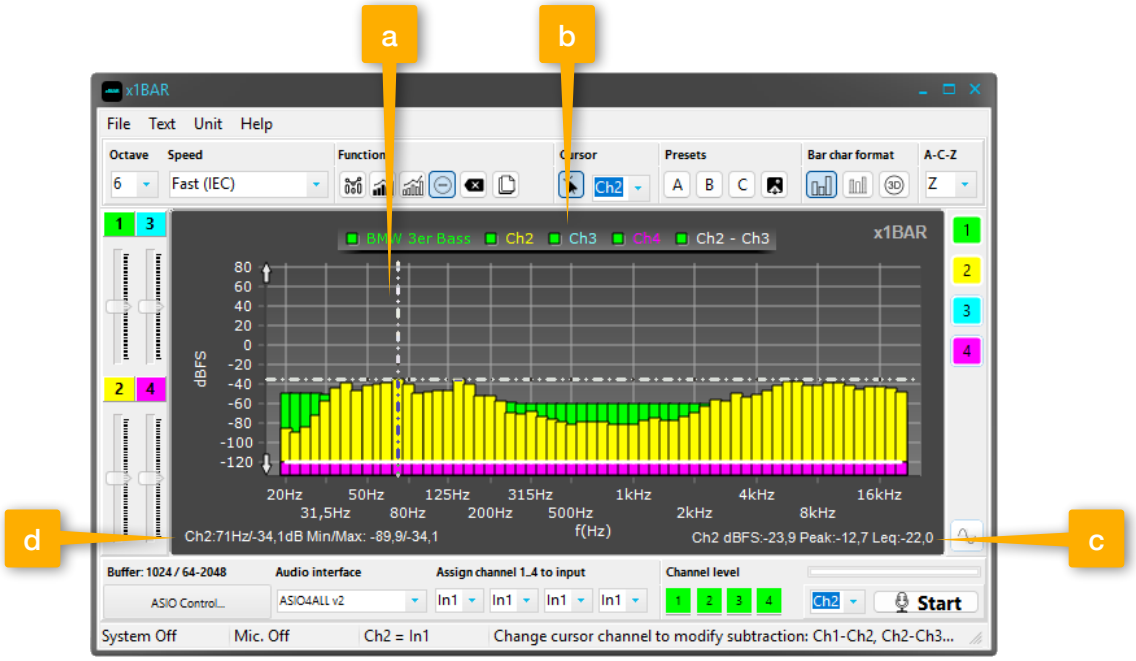
Module Signal-Generator	Opens the module single generator to output test signal: Logarithmic sweep or pink noise *Tip: In combination with the Peak display in the top toolbar (2.c), the speaker's frequency response can be easily determined using pink noise or a 20 Hz–20 kHz sweep at 30 seconds + "IEC Fast".*

5.2.4. Bar chart (4)



Tip:

- *You can move overlapping graphics vertically using the offset sliders in the left toolbar (7), or*
- *make them visible by enabling transparency and using the 3D view, if necessary with transparency set to "on" or the offset sliders (5).*



Chart

Cursor (a)	The cursor displays the x/y measurement values for a display channel. It is activated via the top function bar (2), where the display channel is also selected. It 'sticks' to the bar height for each frequency of a display channel. Therefore, the display channel must be selected beforehand. Under (d) are the measured values for the position as well as the min/max values of the display channel.
Header Legend (b)	Displays a short text for the measurement matching the channel color. You can change it via the header menu „Text" from RTA module. *Tip: If the small coloured rectangle in front of the text is missing, the channel is hidden (see Ch4).*

Measurements (c)	x1BAR displays the measured values: Leq, PeakdB, as well as, depending on the selected unit, dBFS, dBFS RMS, or SPL dB. If the measurement is weighted, e.g., with an “A” filter, the measured values are dBFS(A), dBPeak(A), SPL dB(A) and LAeq. *Note: „**H** Peak“ => Peak Hold function enabled (see header menu „Unit“)*
Measurements Cursor (d)	x1BAR displays the measured values at cursor position

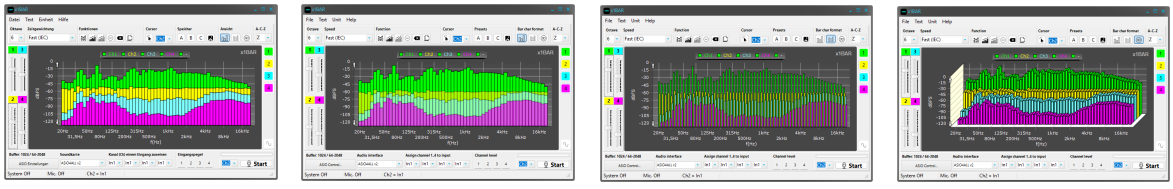
---

Popup Bar Char

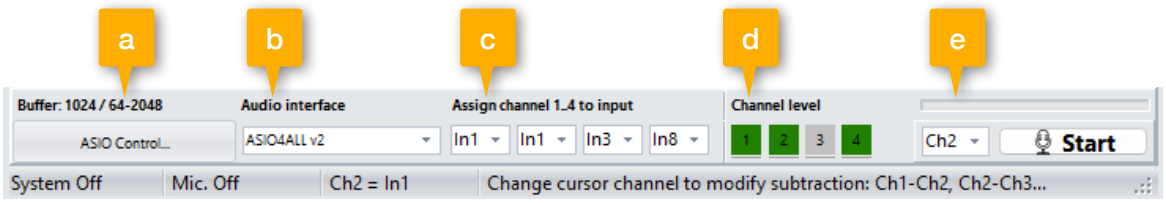
y/2:	y axes Minimum/Maximum divide by 2
y*2:	y axes Minimum/Maximum multiple by 2
xy Standard:	Set x & y axes to default
y-Auto	Scale the y-axis to measured values
Transparency on:	The bars for display channels 2–4 are slightly transparent, allowing other channels to show through. Ideal for comparing channels
Transparency off:	Transparency for display channels 2–4 off
Clipboard	Copy the bar chart to the clipboard
Reset	Reset the peak and Leq readings. Clear the bar chart
CH1 <-> CH2... :	Swap the order of the displayed channels. This allows a display channel with an overlay to be brought to the front. *Note: Channel 4 is at the very front.* *Please note: This function is not available in measurement mode. Alternatively, use the channel input assignment (lower toolbar 5c)*

5.2.4.1. RTA bar chart formats

From top to bottom: Standard, Standard with transparency, Shifted, 3D.



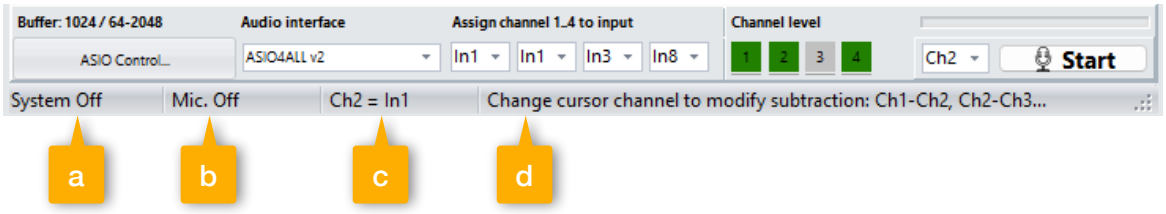
5.2.5. Lower toolbar



Lower toolbar (5)

ASIO Control (a)	Open the ASIO driver settings provided by the sound card manufacturer or an alternative such as ASIO4ALL. Here you can adjust the ASIO buffer size. The default setting is 1024. If you hear noise in the audio output or the display fluctuates unusually, increase the buffer size gradually to higher values.
Audio interface (b)	Select an audio interface.
Assign channel 1..4 to input (c)	Assign a sound card input to each of the 4 display channels: the left side starts with display channel 1, followed by 2 and 3. The right side ends with display channel 4. Audio interface inputs can be assigned multiple times.
Channel level (d)	The four fields for display channels 1–4 use colour codes to indicate the input levels. If, as shown in the diagram above, Ch4 is assigned to input 8 of the sound card, then the level applies to input 8. Colour codes: Grey: No signal. Green: Low signal. Light green: Ideal signal. Red: Signal overloaded.
Button Start (e)	Select a display channel (Ch1–4) for the measurement. Press the 'Start' button to begin the measurement. Pressing it again stops the measurement. *Tip: You can change the display channel whilst in measurement mode.*

5.2.1. Footer



Footer (6)

System On (a)	Audio interface frequency correction: • System On: Sound card calibration is taken into account during measurement • System Off: Sound card calibration is NOT taken into account *Tipp: You can perform the calibration and enable it in the Setup module.*
Mic Off (b)	Microphone frequency correction: • Mic Off: Microphone is not corrected • Mic 0°: Microphone correction using the free-field measurement file • Mic >0°: Microphone correction using the diffuse sound measurement file *Tip: You can assign the calibration files 'Free-field' (0°) or 'Diffuse' (>0°) to each audio interface input and activate them in the „Setup" module.*
Chx = Iny (c)	The bar graph displays the measurement from display channel x, which receives signals from audio interface input y
Notes (d)	Information on functions or the measurement procedure

5.2.1. Left toolbar (7)

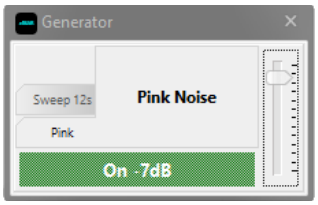
Toolbar left

Slider 1 to 4	The 4 controls shift the bar graph channel 1..4 vertically by +/- 20dB (offset). This allows overlapping measurements to be made visible. *Tip: Alternatively, select a different display mode, such as 3D, or enable transparency mode (bar graph pop-up menu).*

Popup Menu toolbar left

Ch1 Offset 0:	Set Offset of Ch1 to 0
Ch2 Offset 0 to Ch4 Offset 0:	Same as Ch1 Offset 0 for channel 2..4
All Offset 0	Set for all 4 channels the offset to 0

5.3. Module Generator (Test Signals)



The generator outputs test signals as logarithmic sweeps and pink noise through all outputs of the sound card. It is accessed via the right function panel (3).

The volume is set in the software using the right-hand slider. The display corresponds to the dBFS Peak of the audio interface D/A converter. The peak value of a sine signal corresponds to 0 dBFS. The “On” button shows the level from the software.

Tipp: In addition, the output level can be adjusted, if available, using the sound card’s output controls (see the sound card manual).

5.3.1. Signal Type Pink (Pink Noise)

Playback of “Pink Noise,” also known as “Rosa Rauschen.” There are no special parameters for this test signal.

5.3.2. Signal Type Sweep

Single playback of a logarithmic sweep signal. The following parameters are available:

- **Start/Stop**: Start and stop frequency of the sweep signal in Hz. Change the value by clicking in the LED display. Enter the new value using the PC keyboard numeric keys and confirm with Enter.
- **Duration Slider**: Adjusts the duration of the sweep signal. Slider at the top = 10s, slider at the bottom = 40s.

5.3.3. Start/Stop Signal Output

Press the “On” button to prepare the next signal output for measurement. To start playback, press the “Start” button in the RTA module from the lower function panel (5).

5.4. Modul Setup

5.4.1. Page “Cal. system”

x1BAR corrects frequency response deviations caused by the audio interface. Follow the procedure from chapter “Calibrate the audio interface.”

5.4.2. Page „Mic. response“

For each input on the audio interface, a frequency response correction file for 0° (free field) and >0° (diffuse acoustics) can be stored here. Use the pop-up menu to add or remove the file.

To do this, select an input via the “Input” column. Now open the pop-up menu by right-clicking the mouse over the table and select a function:

Popup Menu microfon correction	
Change file 0°	Select correction file: Free field
Change file >0°	Select correction file: Diffuse acoustics
Remove file 0°	Delete file free field
Remove file >0°	Delete file diffuse acoustics

To apply the correction, select Free Field (0°) or Diffuse acoustics (>0°) under “Correction” and close the setup dialogue by clicking “Save”. Select “Off” to disable the correction.

5.4.3. Page „Mic. SPL“

To ensure accurate SPL measurements, the combination of microphone and audio interface input gain must be calibrated. Standard sound level calibrators are used for this purpose. Calibration is carried out separately for each input.

Important: The calibration applies only to the combination of the microphone input with the set gain and the microphone. Any subsequent changes to the gain will render the SPL measurement unusable. Please recalibrate.

Please note: The opening for the microphone in the SPL calibrator must fit your microphone. The opening can be adjusted using adapters. These are supplied by the manufacturer either with the microphone or with the calibrator. Standard sizes for microphones include, for example, the 1/2” type (outer diameter 13.2 mm) or the 1/4” type (outer diameter 7.0 mm).

Hardware steps:

- Connect the microphone to the audio interface
- Adjust the input gain with the microphone to your needs, e.g. to 50%
- If required, switch on +48V phantom power
- Insert the microphone into a microphone calibrator
- Start the 94 dB output on the calibrator (wait for the warm up start phase if necessary)

x1BAR steps:

- Open the setup and go to the “Mic:SPL” tab.

- Under step 1, select the microphone input in the “Input” column.
- Under step 2, press the “Start” button.
- Wait until the offset value appears in the text field.
- Under step 3, transfer the offset to the sound card input in the list under step 1.

Done. You can now measure SPL accurately in the RTA module. Set the unit to SPL dB via the menu in the header.

5.4.3.1. Tip: Is your microphone not compatible with a sound level calibrator?

You can also calibrate your microphone using a second calibratable microphone, perhaps one borrowed from a friend:

1. Please check the following first
    1. Setup page “Mic SPL”: The offset for Input 2 is 0. If not, set the value to 0 as follows:
        1. Select Input 2
        2. Enter “0” in the Offset field using the keyboard
        3. Click the “Apply” button and exit the setup with “Save”
    2. RTA module: Left function bar. Offset for all 4 channels is 0
2. Connect microphone A (calibratable) to input 1 of the audio interface
    1. Gain for input 1: 50% (adjust if necessary if the signal is overloaded)
3. Connect Microphone A to the sound level calibrator. Proceed the SPL calibration (see previous steps under Hardware / x1BAR for procedure)
4. Measurement with microphone A in the RTA module using the “Pink Noise” test signal. Time weighting “Slow”, 1/3 octave, **unit “SPL dB”**
    1. Measure pink noise via a loudspeaker
    2. Note the measured value at 1 kHz. Read it out using the cursor if necessary
5. Connect microphone B to input 2 of the sound card
    1. Set the gain to a value between 50% and 75%
    2. Measurement on display channel 2
6. Perform the measurement as in step 3. Note the measured value for 1 kHz
    1. Formula: Offset = SPL B - SPL A, e.g.: SPL B = 42 dB and SPL A = 42 dB => Offset = -18
7. Enter the offset in the table
    1. Select the sound card input via the row
    2. Enter the offset in the text field
    3. Click the “Apply” button
8. Exit the setup by saving

Note: You can also perform a similar calibration using sound sources with a known SPL, e.g. loudspeakers and a sine wave signal. For example, according to the datasheet, the SPL is 88 dB at 2.83 V at 1 m and 1 kHz. Start with step 5. In this case, SPL A is 88 dB.

6. Measurement Workflows

6.1. RTA Measurement

For measurements with the RTA module, connect one or more microphones to the audio interface. Turn on the +48V phantom power if your microphones require it.

6.1.1. Measurements with Pink Noise as Test Signal

Hardware

Connect the output or headphone output to the active speaker or amplifier. Switch on the active speaker/amplifier only after making the connection. Ensure that the volume is not too high.

x1BAR

- Start the “Generator” from the right function panel
- Select the “Pink” tab
- Set the level to -10 dB
- Press the “On” button
- Continue with “Measurement without Pink Noise…”

6.1.2. Measurements without Pink Noise as Test Signal

(e.g., measuring the sound spectrum of a device or ambient noise)

Hardware

See previous section “Measurement with Test Signal…”.

x1BAR

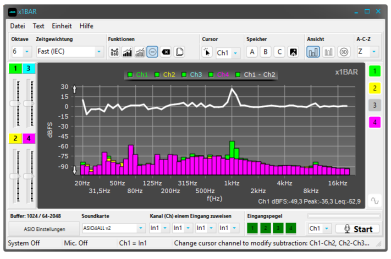
- Select the frequency resolution: Recommended is 1/3 or 1/6 octave in the RTA module header
- Determine time weighting, e.g., IEC Fast
- Select a display channel Chx (left of the “Start” button)
- Press “Start” to begin the measurement

Options (see “Top Toolbar“):

- Peak or differential measurement
- Frequency weighting A or C; Z is unweighted (linear)

6.1.3. Differential measurement

Differential measurement is very useful for comparative measurements, such as those involving sound profiles. One channel contains the reference value and the other contains the current measurement. The difference is shown in red.

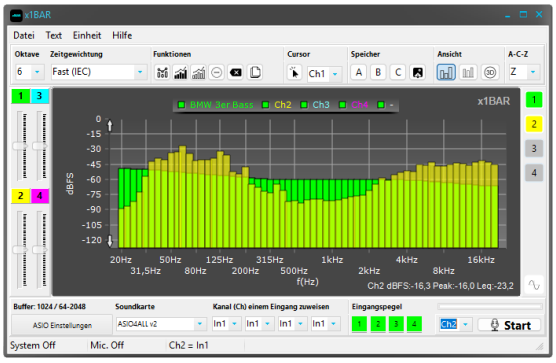


6.2. Work with Sound Profiles (e.g. Car-Hifi)

Car audio systems should not be tuned linearly due to the spatial structure and materials. But what does proper tuning look like? Our reference curves = sound profiles provide guidance.

They are loaded into x1BAR display channel 1 and compared with the current measurement on channel 2. Use the car's EQ or audio DSP to match the live measurement to the target profile.

x1BAR comes with a standard profile. Additional profiles are available for free from our product download page.



The workflow is as follow:

Hardware

- Microphone: Connect to Input 2 (right) of the audio interface, pointing upwards. Use >0° (diffuse) correction if available

Test Signal Output

- Pink Noise via x1BAR: Connect the audio interface output to the car Hi-Fi system while it is switched off
- External Option: Play pink noise from an audio CD
- Ensure that the volume is not too high

Measurement Procedure

- Assign Input 2 to display channel 2 (lower x1BAR function bar)
- Select "File / Load Sound Profile"
- Choose the sound profile. RTA display channel 1 now shows the profile
- Set the display channel to Ch2
- Open the generator:
  - Select "Pink"
  - Set level to -10 dB
  - Press the „On" button
- RTA module: Start the RTA measurement by pressing "Start"
- Use the offset control (left x1BAR panel) to align channel 2 with the reference curve at 1 kHz
- Adjust the EQ/Audio DSP until the yellow Ch2 curve matches the profile

Tip: Use the difference between Ch1 and Ch2 to help with the balancing. The aim is to get the difference curve as close to 0dB as possible across all frequencies.

6.2.1. Create your own Sound-Profiles

Tip: Sound profiles aren't just for car audio. As shown in the example, you can also create templates for live performance or home cinema sound and recall them for fine-tuning as needed.

There are two ways to create profiles:

1. Measurement in the RTA module

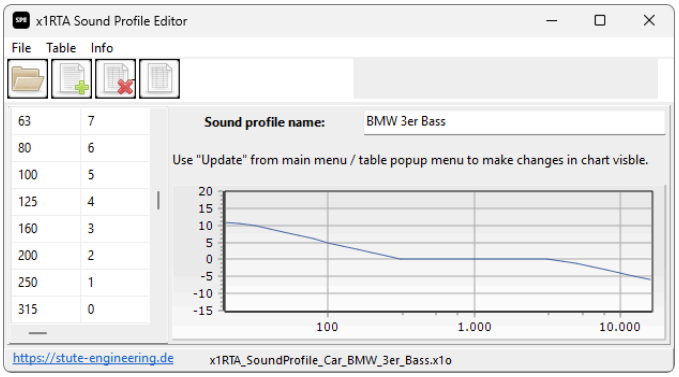
- Use 1/3 octave, speed „IEC slow" and select channel Ch1 for measurement
- Use pink noise to measure your 'sound template' in the RTA module
- Stop the measurement
- Save the measurement via the main menu: 'File / Save as Sound Profile'
- Adjust the profile as required using the "Sound Profile Editor" tool (see point 2 below)

2. With the Tool Sound Profil Editor

- Enter the frequency response using pairs of values
- A pair of values consists of a frequency and the gain, as is common with many microphone correction files
- A positive gain value indicates that the frequency is boosted (it should be reproduced at a higher volume)

Tip: You can also import the data pairs from a TXT file, using the delimiter ";"

You can download the editor for free from the Download section on our website.



7. Specifications

7.1. Module RTA Analyzer

- Up to 10 microphones (In 1..10)
- 4 display channels (Ch 1..4)
- Octave: 1/1, 1/3, 1/6
- IEC 61672 time weighting: Impulse, Fast, Slow
- Frequency range: 20 Hz to 20 kHz
- Sound card frequency response correction
- Microphone frequency response correction per input: free-field (0°) and diffuse acoustics (>0°)
- SPL calibration with 94 dB calibrator
- A-C-Z frequency weighting
- Bar char views (4 channels): overlapping, offset, 3D with transparency
- Offset ±20 dB per channel
- Display options: Peak, Peak + Decay, Snapshot, Difference
- Temporarily save measurements (Copy & Paste)
- Cursor with measurement values
- Save, print or copy measurements to the clipboard
- Measurement values: Leq, Peak, dBFS or dBFS RMS

7.2. Module Generator

- Level: -60 to 0 dBFS
- Log Sweep
  - Min: 15 Hz, Max: 22 kHz
  - Duration 10s - 40s
- Pink Noise

8. System Requirements

8.1. PC

- Windows 10/11, 32/64-bit
- Intel i3 2 GHz or faster
- Screen 1024×768 or higher
- Keyboard, mouse

8.2. Audio interface

- ASIO drivers required (WDM is not supported)
- Adjustable mic input channels 1–10
- 48 V phantom power
- Sample rate: 48 kHz
- Resolution: 16/24/32 bit
- Min. 1 adjustable audio or headphone output
- Examples:
  - Multi channel (4+): Behringer UMC1820/404HD
  - Stereo: Behringer UMC202HD, Mackie Onyx Producer 2.2, Steinberg UR22 mkII

8.3. Measurement microphones

- Frequency response: 20 Hz to 20 kHz, as linear as possible
- A sound level calibrator with a 94 dB output is required for SPL calibration of the microphone.

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