
T-Sonus Software Manual



This user guide is designed to provide documentation for T-Sonus, . Read these instructions carefully



Description: Software Manual for T Sonus:

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We have made sure that the manual is free from any errors to the best of our knowledge, in case of any inconsistencies (contact our support) we shall clarify and make the rectification as soon as possible.

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General Instructions

Installing the Software

System Requirements

Processor	Pentium 4M/Celeron 866 MHz (or equivalent) or later (32-bit) Pentium 4 G1 (or equivalent) or later (64-bit)
RAM	4 GB
Screen Resolution	1024 x 768 pixels
Operating System	Windows 10 or higher
Disk Space (Min)	2 GB

For installing the software in Windows 10/ higher versions is recommended, follow the steps below.

Installing the TVIB Software

1. Download T-Sonus Installer.& Driver.
2. Run the Install.exe file and complete the installation.

Installing the Driver file

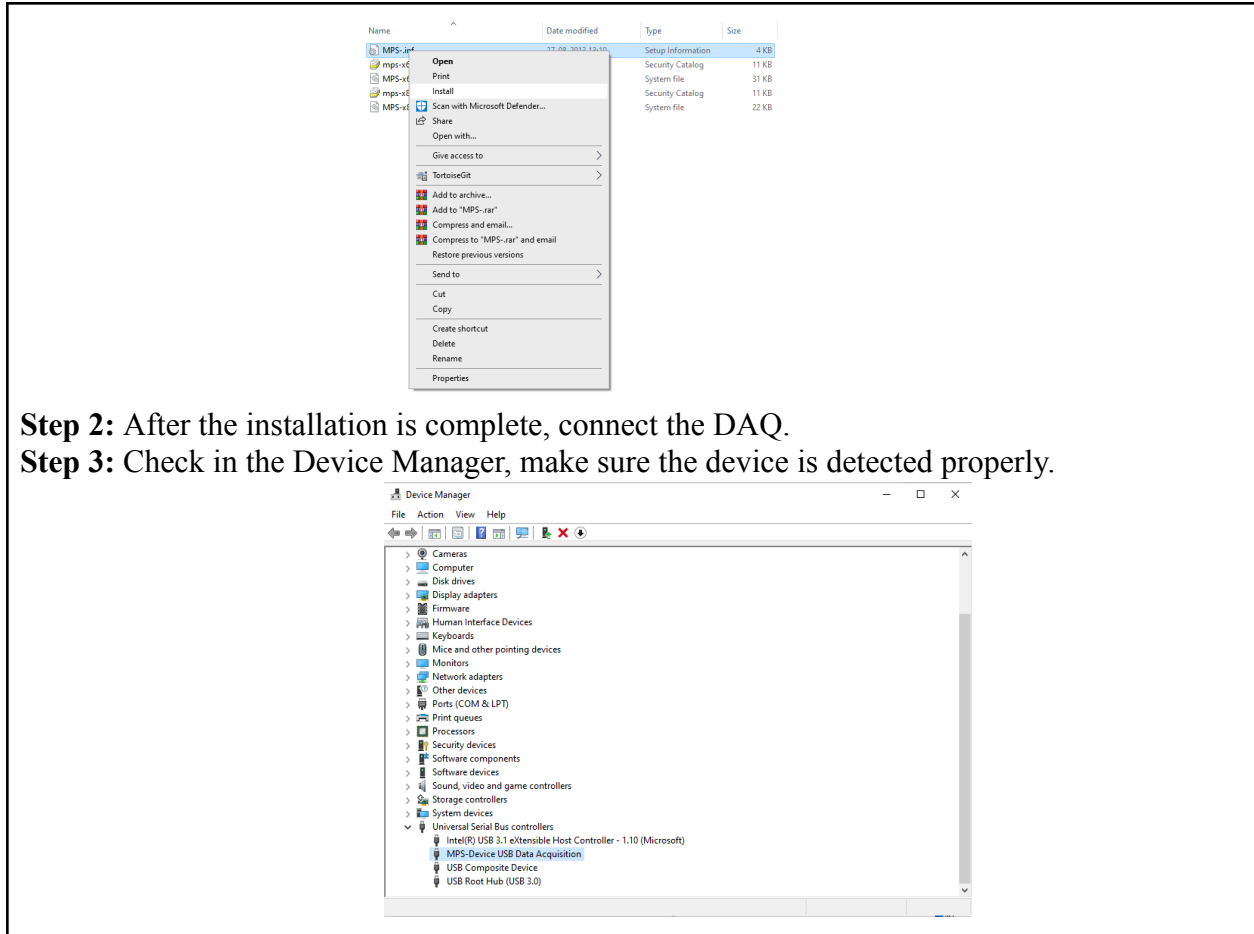
Note:

Only for Phonovibe Q/O/HD

Phonovibe D does not require any additional driver file installation.

Step 1: Download & Extract the driver, and install the **.inf** file.

Note: Make sure the device is not connected to the PC while the driver is installed.

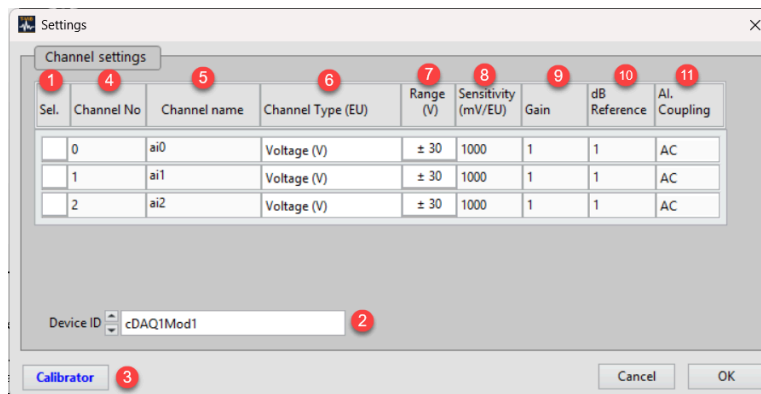


Step 2: After the installation is complete, connect the DAQ.

Step 3: Check in the Device Manager, make sure the device is detected properly.

3. Open T-Sonus from the desktop or Start menu to begin.

Channel Settings



1 - Active Channel: Click the check box to enable a channel.

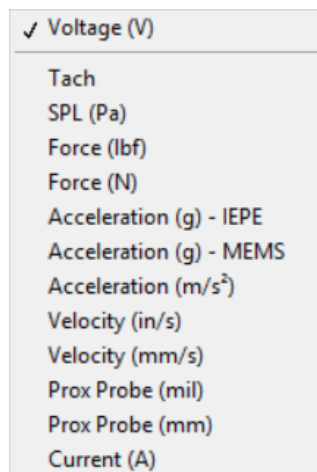
2 - Device ID: This displays the ID of the Data Acquisition Device connected to the software. 0 is the Default ID for Phonovibe Q/O/HD.

3 - Calibrator button: Click to calibrate the sensor in real-time with an independent calibrator (Vibration Calibrator/ Microphone Calibrator) connected to the Data Acquisition device. This option is only available for Microphone & Accelerometer

4 - Channel No. : Number specified for channel

5 - Channel Name: Give a suitable channel name to denote the data from a particular sensor in the graphs or measurement.

6 - Channel Type: Specifies units of measurement & the Sensor connected to the channel. Following are the general units of measurement & Sensor type used.



7 - Range: Enter the maximum range of voltage, the sensor would output to the Data Acquisition device.

8 - Sensitivity: Sensitivity is the voltage output (in millivolts) per unit of the Engineering Unit.

9 - Gain: The signals which are amplified using external hardware can be accounted for by the Gain option .

10 - dB Reference: Is the reference with which the logarithmic (in decibels) is measured. The decibel is a logarithmic ratio between two numbers – a measured value and a reference value. It is shown in two forms below: Equation 1 for POWER quantities, and Equation 2 for field AMPLITUDE quantities.

$$dB = 10 \log\left(\frac{W}{W_{ref}}\right)$$

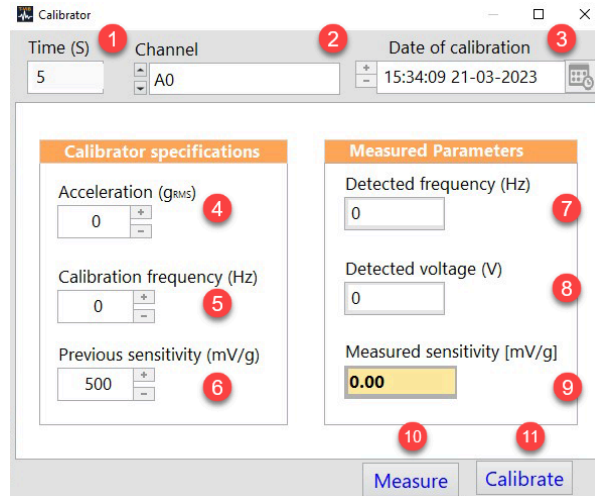
$$dB = 10 \log\left(\frac{x}{x_{ref}}\right)^2 \quad \text{or} \quad dB = 20 \log\left(\frac{x}{x_{ref}}\right)$$

11 - AI Coupling: Analog Input coupling refers to the coupling options available in the Data Acquisition device.

Calibrator function

Software option to be used with the sensor mounted on an independent calibrator with the input signal parameters to be entered in the calibration window.

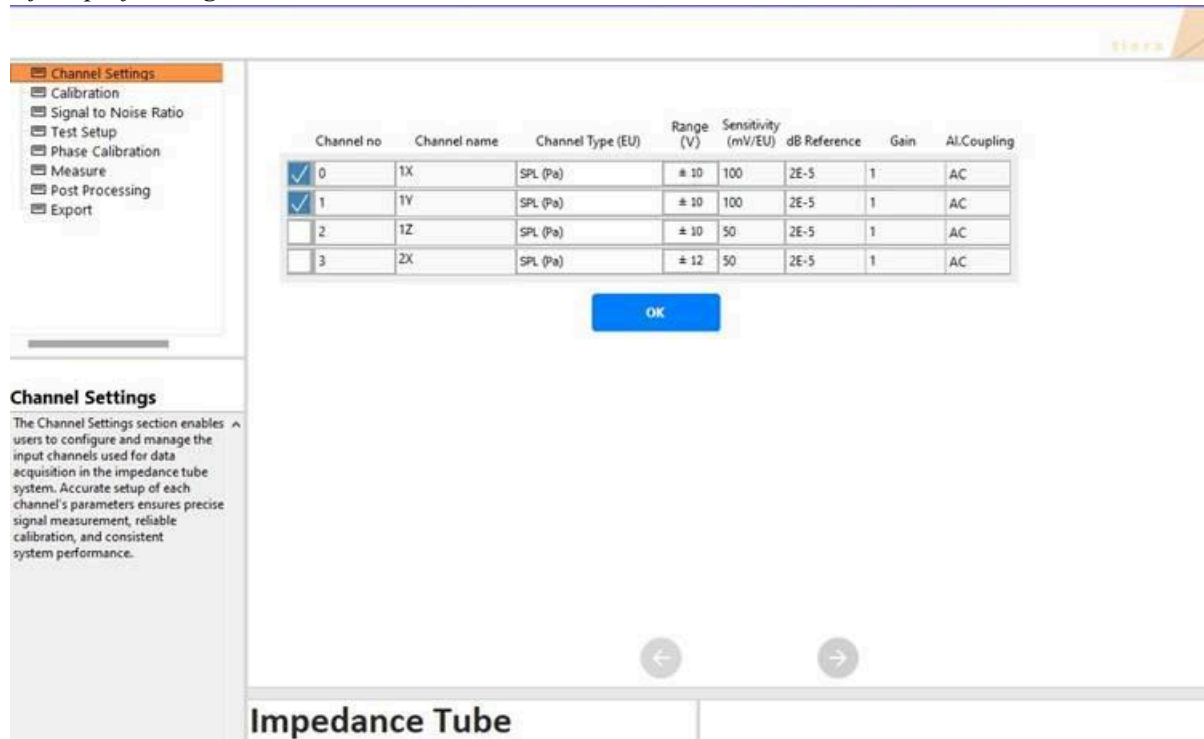
Note: Only for Microphones & Accelerometers



- 1 - Time (s): Time frame of the signal collected from the sensor.
- 2 - Channel: The name of the channel which is to be calibrated.
- 3 - Date of Calibration: Set the date on which calibration is done.
- 4 - Acceleration (g rms): The acceleration level of vibration in the calibrator.
- 5 - Calibration frequency: The frequency of vibration set in the calibrator.
- 6 - Previous Sensitivity: The previous sensitivity value entered by the user or obtained in the last calibration.
- 7 - Detected frequency: The frequency of vibration measured from the calibrator by the sensor in real time.
- 8 - Detected voltage: The Voltage Output from the sensor corresponds to the input measured from the calibrator by the sensor in real time..
- 9 - Measured Sensitivity: The sensitivity value of the sensor measured from the Calibration procedure.
- 10 - Measure: Press the Measure button to calculate the sensitivity value from the calibration procedure.
- 11 - Calibrate: Press the calibrate button to automatically set the sensor sensitivity value measured from the calibration procedure.

Channel Settings

To configure and verify the input channels for accurate signal acquisition in the impedance tube system before performing calibration and measurement.



Theory / Description

The Channel Settings section allows the user to define each input channel's parameters such as range, sensitivity, gain, and coupling mode.

Proper configuration ensures:

- Reliable signal capture
- Consistent calibration
- Correct SPL (Sound Pressure Level) measurements

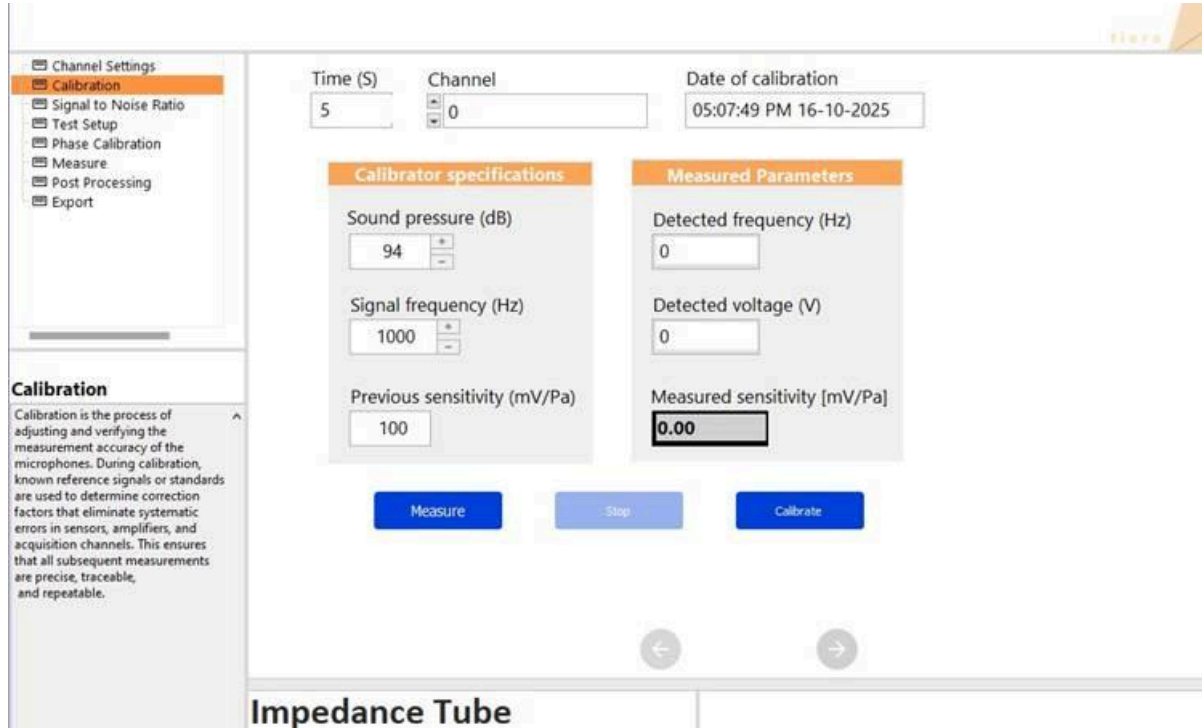
Each channel corresponds to a connected microphone or transducer used in the impedance tube.

Term Definitions

Term	Definition
Channel No	The identification number assigned to each input channel of the data acquisition system.
Channel Name	A user-defined label for each input channel (e.g., 1X, 1Y). Used for easy identification in later steps.
Channel Type (EU)	The engineering unit of the signal measured. For acoustic tests, this is usually SPL (Pa) – Sound Pressure Level in Pascals.
Range (V)	The voltage range that the input channel can measure. For example, ± 10 V means signals within -10 to +10 volts can be acquired without clipping.
Sensitivity (mV/EU)	Represents how much electrical voltage corresponds to one engineering unit of sound pressure. For example, 100 mV/Pa means 100 millivolts equals 1 Pascal of pressure.
dB Reference	The reference value in Pascals (Pa) used for converting the measured signal into decibels (dB SPL). Commonly 2×10^{-5} Pa, which corresponds to 0 dB SPL (the threshold of hearing).
Gain	Amplification factor applied to the signal before digitization. A gain of 1 means no amplification.
AC Coupling	Specifies how the input channel handles DC components. AC Coupling blocks DC and allows only AC signals (useful for microphone inputs).

Microphone Calibration Using Sound Calibrator

To determine the measured sensitivity (mV/Pa) of the microphone using a reference sound pressure and frequency.



Apparatus Required:

1. Microphone under test
2. Sound calibrator (e.g., 94 dB @ 1 kHz)
3. Data acquisition system or analyzer (connected to the software interface shown)
4. Computer with calibration software

Software Interface Sections:

- Calibrator Specifications: Input known calibration reference values
- Measured Parameters: Display measured results from the test
- Control Buttons: *Measure*, *Stop*, and *Calibrate*

Procedure Steps:

1. Open Calibration Module:
Launch the calibration software and navigate to the Calibration tab in the channel settings panel.
2. Set Time and Channel:
 - Enter the Time (s) for measurement (e.g., 5 seconds).
 - Select the Channel number corresponding to the microphone input (e.g., 0).
3. Record Date and Time:
 - The Date of Calibration is automatically displayed by the system for record purposes.
4. Enter Calibrator Specifications:
 - Sound Pressure (dB): Enter the reference pressure from the calibrator (e.g., 94 dB).
 - Signal Frequency (Hz): Input the frequency of the calibrator tone (typically 1000 Hz).
 - Previous Sensitivity (mV/Pa): Input the last known sensitivity of the microphone (e.g., 100 mV/Pa).
5. Connect the Calibrator:
 - Attach the sound calibrator firmly to the microphone.
 - Ensure there is no leakage or background noise interference.
6. Measure the Signal:
 - Click Measure to start data acquisition.
 - The software will record the detected frequency and voltage from the microphone.
 - Observe that Detected Frequency (Hz) and Detected Voltage (V) values update.
7. Calculate Sensitivity:
 - After measurement completes, click Calibrate to compute the Measured Sensitivity (mV/Pa).
 - The software calculates sensitivity using:

$$\text{Measured Sensitivity (mV/Pa)} = \frac{\text{Detected Voltage (mV)}}{\text{Sound Pressure (Pa)}}$$

(Sound Pressure in Pa = 20 μ Pa \times 10^{^(dB/20))})

8. Verify and Save Results:
 - Compare measured sensitivity with previous sensitivity values.
 - If within acceptable tolerance, save calibration results.
 - Export data if required (via Export tab).
9. Stop Measurement:
 - Press Stop to end acquisition if running continuously.

Term	Definition
Frequency (Hz)	The rate at which an acoustic signal repeats per second. Used to measure SNR across different octave bands or frequency points.
SNR1 (dB)	The Signal-to-Noise Ratio measured by Microphone 1 (or Channel 1). Represents the level difference between the test signal and the background noise at that point.
SNR2 (dB)	The Signal-to-Noise Ratio measured by Microphone 2 (or Channel 2). Used for cross-verification and consistency of measurement.
Result	The outcome of the test for each frequency point. Displays “Pass” if the SNR value meets or exceeds the set limit, otherwise “Fail.”
Band Power	The acoustic power calculated within a specific frequency band. Displayed graphically to show signal and noise power distribution.
Limit	The predefined minimum acceptable SNR value (typically ≥ 60 dB) for valid measurements.
Fail / Pass	Indicates that one or more frequency bands did not meet the minimum SNR requirement.
Settings	Opens configuration options such as frequency range, averaging, or measurement duration.
Measure	Initiates the SNR measurement process.
Stop	Terminates the ongoing SNR measurement.

Phase Calibration Procedure

To perform phase calibration between two microphones in the impedance tube system to correct any phase mismatch, ensuring accurate calculation of the acoustic transfer function and sound absorption coefficient.

Phase Calibration

Phase Calibration determines the absorption coefficient of the sample by correcting the phase mismatch between the two microphones. In this process, measurements are taken with the microphones in their original positions and then repeated after switching the microphones. The results are used to eliminate phase errors caused by microphone and hardware differences, ensuring accurate and reliable acoustic property calculations.

Theory / Description

Phase calibration is critical for impedance tube measurements because microphones, amplifiers, and cables can introduce small phase differences.

These differences affect the accuracy of the transfer function used to calculate reflection and absorption coefficients.

By measuring the transfer functions H_{21} and H_{12} (after switching microphone positions), the software determines the phase correction factor (H_c) used to compensate for phase mismatches.

Term	Definition
MicA (Reference Microphone)	The microphone used as the phase reference during calibration. It is placed at position “x1” initially.
Mic B (Measurement Microphone)	The second microphone, used for acquiring the secondary signal at position “x2.”
H21	The transfer function is measured with Mic A as reference and Mic B as the second microphone. Represents the ratio of signals between Mic B and Mic A.
H12	The transfer function is measured after switching the microphones. Mic B becomes the reference, and Mic A becomes the secondary microphone.
Hc	The phase correction factor, calculated from both H21 and H12 measurements to correct for phase mismatch.
Number of Averages	The number of signal averages used to reduce random noise during calibration. Higher values improve accuracy.
Attenuation	Reduces the signal level to prevent overloading or distortion during calibration.
Amplitude vs. Time Graphs	Display the time-domain signals from the microphones during measurement.
Averages Completed / Averaging Done	Indicates progress or completion of averaging during calibration runs.

Term**Definitions****Equipment Required**

1. Impedance Tube setup
2. Two microphones (Mic A & Mic B)
3. Signal generator and amplifier
4. PC with Impedance Tube software

5. Test sample holder (optional, usually empty tube during calibration)
-

Procedure

Step 1: Preparation

1. Ensure both microphones are properly connected and configured in the Channel Settings section.
 2. Confirm that Signal-to-Noise Ratio (SNR) has been checked and passed.
 3. Leave the tube empty (no sample) for calibration.
-

Step 2: Set Parameters

1. Open the Phase Calibration tab in the software.
 2. Set the Number of Averages (e.g., 4–10 averages for stability).
 3. Enable Attenuation if the input signal is too strong.
-

Step 3: Measure H21

1. Keep Mic A in the reference position (near the sound source).
 2. Mic B should remain in the measurement position (further away).
 3. Click Measure H21.
 4. Observe the waveform and ensure signal amplitudes are within range (not clipped or too low).
 5. The system will record the first transfer function H21.
-

Step 4: Measure H12

1. Swap the microphones:
 - Move Mic A to Mic B's previous position.
 - Move Mic B to Mic A's previous position.
 2. Click Measure H12.
 3. Verify that the graph shows a valid signal response.
 4. The system now records the second transfer function H12.
-

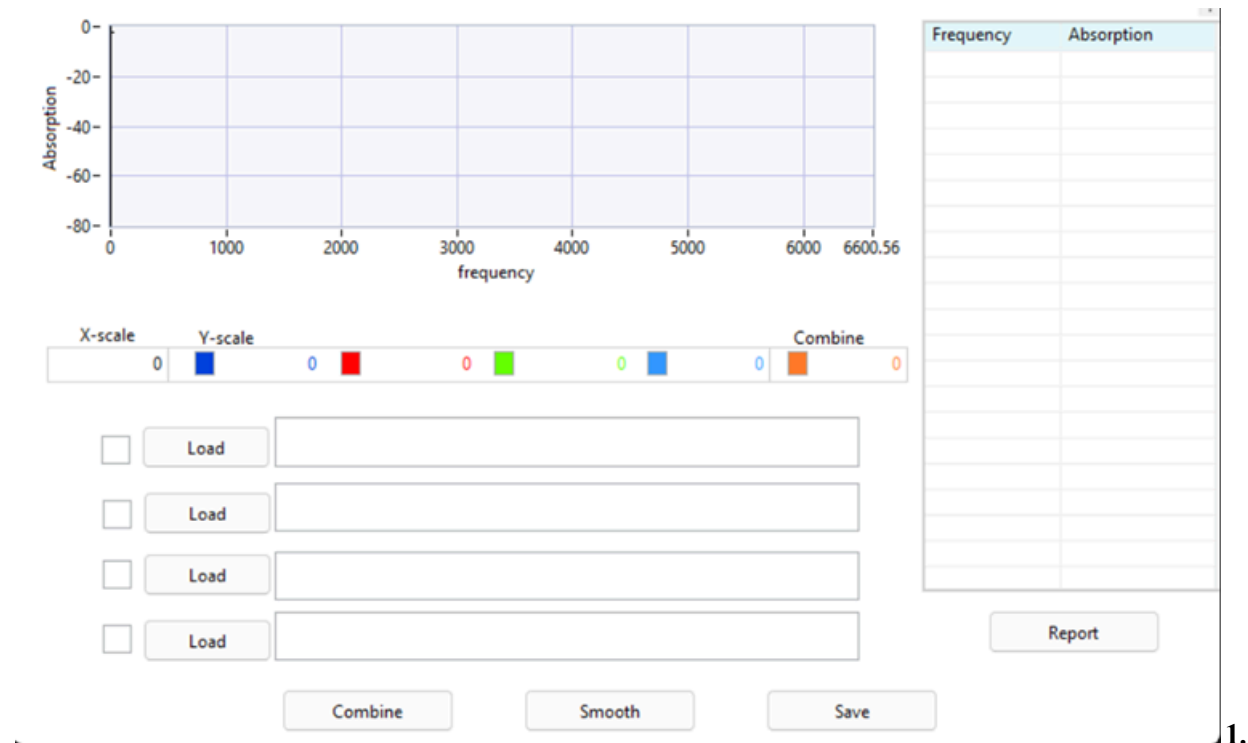
Step 5: Calculate Hc (Phase Correction Factor)

1. After both measurements (H21 and H12) are complete, click Calculate Hc.
 2. The software computes the phase correction coefficient (Hc) automatically.
 3. Check that Averages Completed equals the set number and that Averaging Done is displayed.
-

Step 6: Verification

1. Ensure that the amplitude-time graphs are stable and consistent between H21 and H12.
2. Verify that no unexpected phase jumps or signal distortions are present.
3. If the signals appear noisy or unstable, repeat the process with more averages or improved microphone placement.

Post Processing



Loading Data

- **Instruction:** Click <Load> to choose the result file you want to combine.
- **Explanation:**
 - Each dataset you load represents measurement results (for example, from different frequency ranges or test conditions).
 - Each <Load> button corresponds to a specific title or category shown before it (e.g., *Low Frequency Result*, *Mid Frequency Result*, *High Frequency Result*, etc.).
 - The loaded data must match the title in front of the <Load> button.
 - If you load a mismatched file (e.g., a low-frequency result into a high-frequency slot), the combined data will be **incorrect** because the ranges or parameters won't align.

Typically, you can load **up to four different results**, each representing a different frequency range or segment of your test.

2. Display Control

- **(Checkbox) in front of <Load>:**
 - This checkbox lets you **show or hide** the data that has been loaded and that you plan to combine.
 - Checked → The data will be displayed on the graph.
 - Unchecked → The data will be hidden but remains loaded.
-

3. Combining the Curves

- **Instruction:** Click **<Combine>** to combine the chosen curves.
 - **Explanation:**
 - When you click **<Combine>**, the system merges the loaded data curves (from the different frequency ranges) into a **single continuous curve**.
 - The **combined curve** represents the **original full-range test result**.
 - The combination process ensures smooth transition between ranges so that the overall curve accurately reflects the complete measurement range.
-

4. Smoothing the Combined Curve

- **Instruction:** Click **<Smooth>** to reduce the roughness of the curve.
 - **Explanation:**
 - The smoothing process filters out random fluctuations or measurement noise in the combined data.
 - It helps make the final curve more stable and visually clean without altering the main trend.
 - Typically, smoothing is applied **after** combination to ensure uniformity across the entire frequency range.
-

5. Saving and Exporting Results

- **Instruction:** Save the combined result by choosing the data type under **Export Operation**.
 - **Explanation:**
 - Once the combined curve looks correct, you can save it in various formats (for example, as a data file, text file, or Excel sheet).
 - The software then stores or exports the final processed result for documentation or further analysis.
-

6. Generating a Report

- **Instruction:** Click **<Report>** to fill in material and measurement information.
 - **Explanation:**
 - This section lets you input details such as:
 - Sample name or material code
-

- Test date and operator
- Equipment and test conditions
- Measurement parameters (frequency range, temperature, etc.)
- Once all the information is filled in, you can export the report to **Excel**.
- The exported report includes **test data** for making it suitable documentation or submission

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