MICROPHONE CORRECTION

DEWESoft®

SOFTWARE USER MANUAL

MICROPHONE CORRECTION V23-1

1. Table of contents

2. About this document

This is the users manual for the Microphone correction software module in DEWESoftX.

Legend

The following symbols and formats will be used throughout the document.

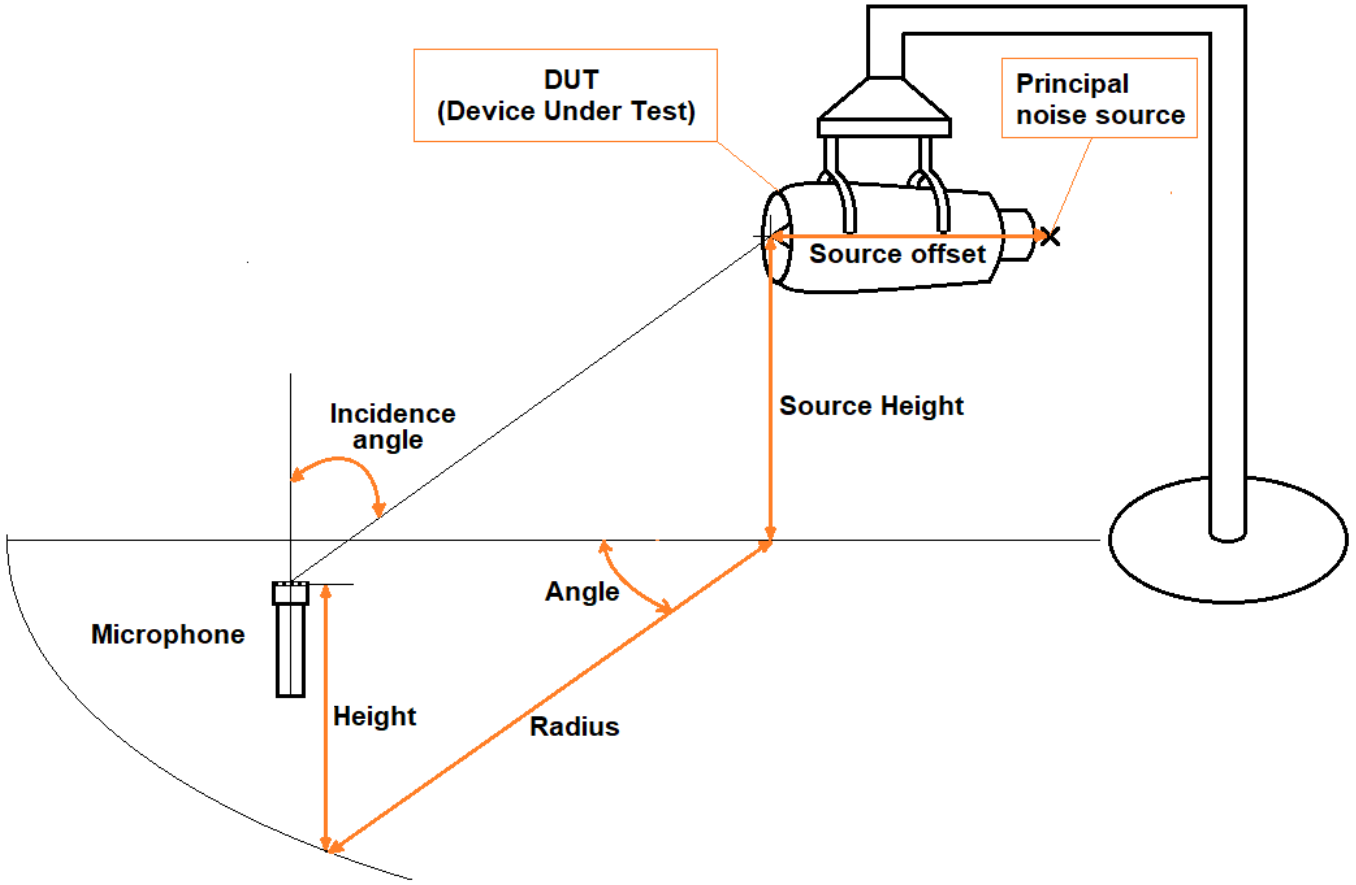
Important
It gives you important information about the subject.
Please read carefully!

Hint
It gives you a hint or provides additional information about a subject.

Example
Gives you an example of a specific subject.

3. Introduction

The Microphone correction module is intended for noise measurement where corrections of sound pressure levels and spectral data must be corrected for the microphone response, system response, sound incidence angle, air absorption and many other corrections, allowing the test to adhere to the standards presuming such applied corrections when performing DUT (Device Under Test) noise measurements:



The sketch illustrates some of the parameters used when applying microphone corrections. In most of such applications multiple microphones are used simultaneously to cover the full picture of the radiated noise.

The Microphone correction plugin has been designed to run in parallel with the original microphone channels in order to easily monitor and analyze the differences between measurements with and without applied microphone corrections.

3.1 User workflow

The user workflow is created to follow all or a subset of the the general tasks listed below:

- Before
  - System frequency response before
  - Sensitivity calibration before
  - Microphone response setup
  - Environmental dependency setup
  - Mic. distances, sound incidence and other custom correction setup
- DUT measurement
  - Background measurement before
  - DUT noise measurement
  - Background measurement after
- After
  - Sensitivity calibration after
  - System frequency response after

Hereby the DUT (Device Under Test) can have the noise measurements performed with all related corrections taken into account, while also being compared to the original microphone measurements with no corrections.

3.2 Output result data

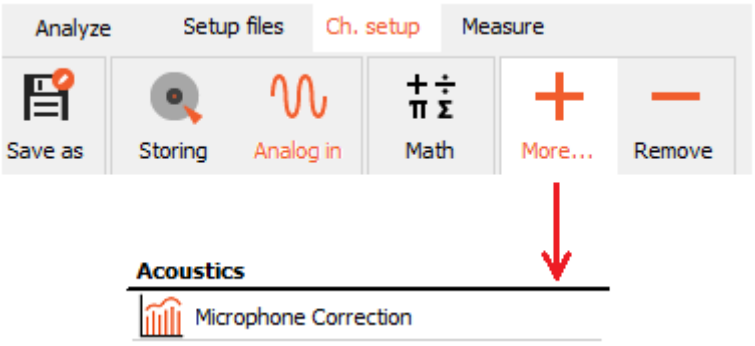
For each microphone used in the Microphone correction module, you will get a list of output results as indicated below:

- Total measured level - total RMS level, based on the related Octave spectrum
- DUT/Source noise spectrum - see Noise measurement
- Corrected Octave spectrum - see Spectral data
- Corrected FFT spectrum - see Spectral data
- System frequency response Before - see System frequency response
- System frequency response After - see System frequency response
- Sensitivity correction Before - see Sensitivity calibration
- Sensitivity correction After - see Sensitivity calibration
- Background noise Before - see Background noise
- Background noise After - see Background noise

Some of the results will be used in display widgets for monitoring and analysis, others are used in setup tables for signal correction processing.

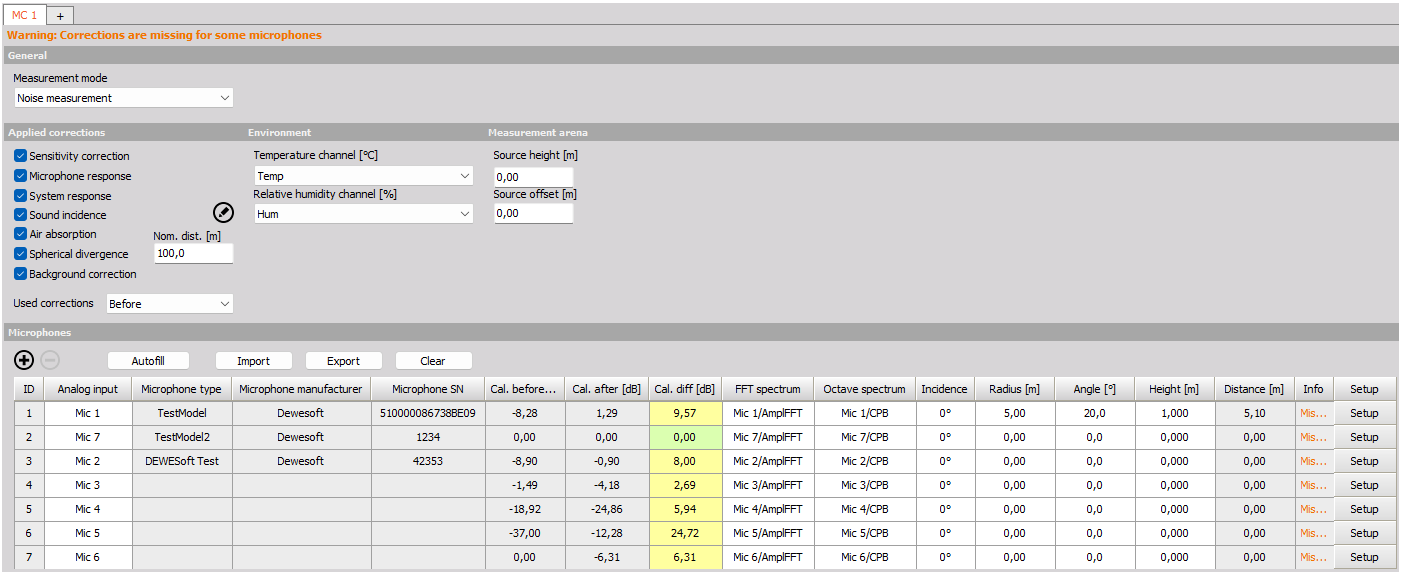
4. Adding Microphone correction to a setup

The Microphone correction module can be found under the Acoustics section in the list of modules to add when pressing the 'More...' button under Ch. setup:



The Microphone correction module can be added under More... in the Acoustics module section.

After adding the module you will see a setup that is meant to be used for both different initial correction measurements, and for actual DUT noise measurements with the measured corrections applied to it.



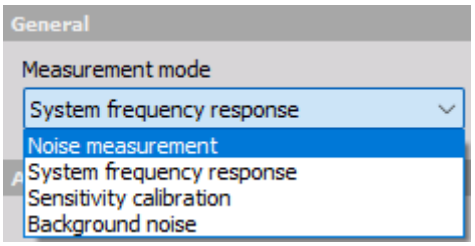
ID	Analog input	Microphone type	Microphone manufacturer	Microphone SN	Cal. before...	Cal. after [dB]	Cal. diff [dB]	FFT spectrum	Octave spectrum	Incidence	Radius [m]	Angle [°]	Height [m]	Distance [m]	Info	Setup
1	Mic 1	TestModel	Dewesoft	510000086738BE09	-8,28	1,29	9,57	Mic 1/AmplFFT	Mic 1/CPB	0°	5,00	20,0	1,000	5,10	Mis...	Setup
2	Mic 7	TestModel2	Dewesoft	1234	0,00	0,00	0,00	Mic 7/AmplFFT	Mic 7/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup
3	Mic 2	DEWESoft Test	Dewesoft	42353	-8,90	-0,90	8,00	Mic 2/AmplFFT	Mic 2/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup
4	Mic 3				-1,49	-4,18	2,69	Mic 3/AmplFFT	Mic 3/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup
5	Mic 4				-18,92	-24,86	5,94	Mic 4/AmplFFT	Mic 4/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup
6	Mic 5				-37,00	-12,28	24,72	Mic 5/AmplFFT	Mic 5/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup
7	Mic 6				0,00	-6,31	6,31	Mic 6/AmplFFT	Mic 6/CPB	0°	0,00	0,0	0,000	0,00	Mis...	Setup

Showing the Microphone correction module setup. In this example 7 microphones are added to the module.

Note: All measurements will be performed under the Measure section after completing the setup under the Ch. setup section.

5. Measurement modes

Under General you must select which Measurement mode you are going to perform. Different related parameters will appear next to the measurement mode depending on which mode you choose:

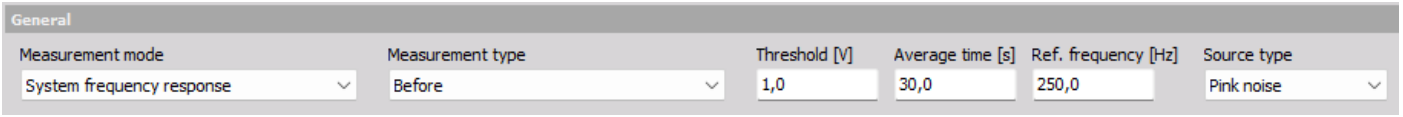


Showing the different Measurement modes which are used at different stages of the measurement procedure, as listed in 3.1 User workflow

5.1 System frequency response

System frequency response is used to measure and correct for the system transfer function - the connection line from the start of the sensor cable to the acquired data samples.

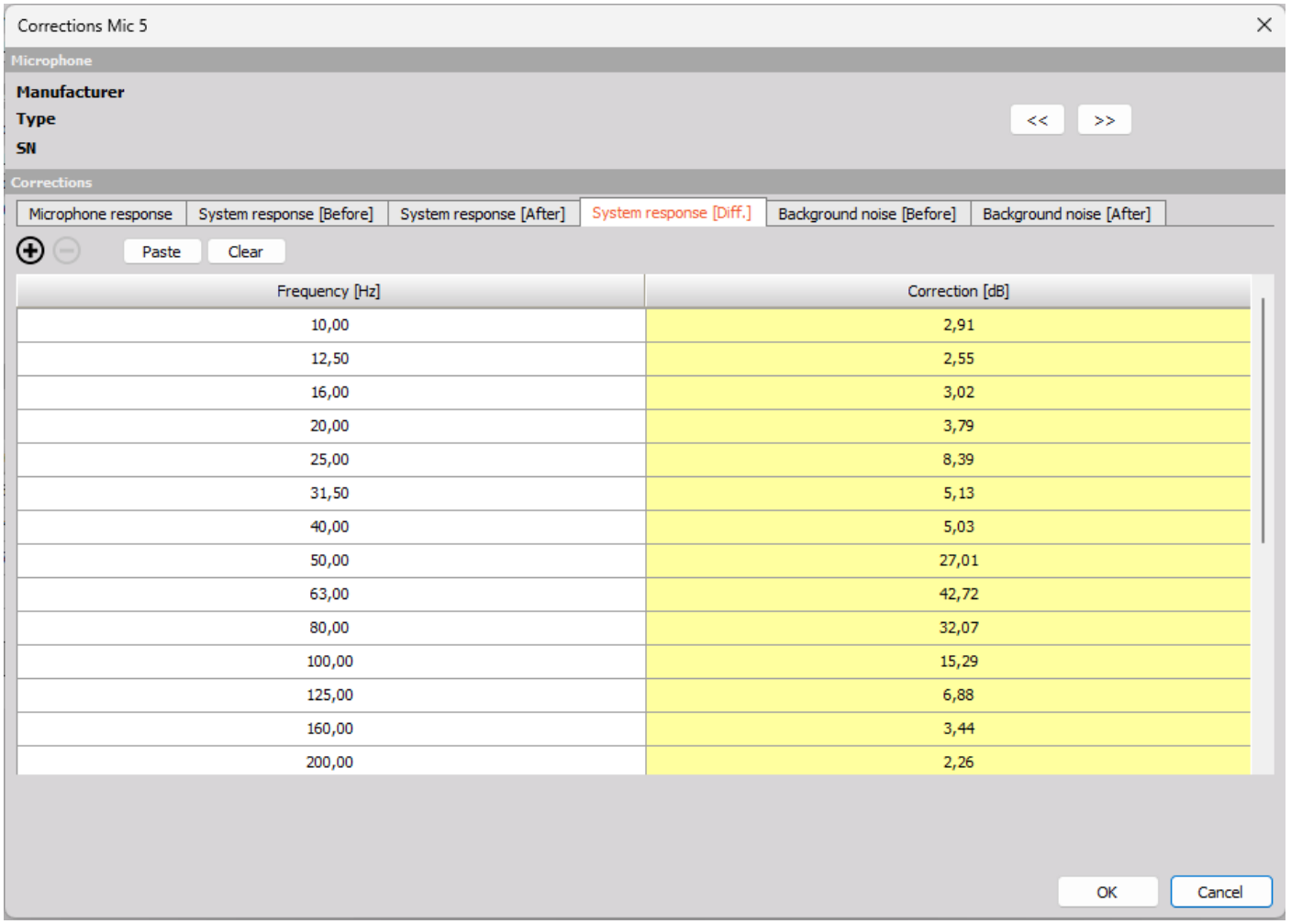
Such system response correction measurements are done by exchanging the microphones with a signal generator that sends out a known signal type and level. The supported generator signal types are Pink noise and a Custom defined type. These are listed under the Source type parameter.



Setup parameters specifically for the System frequency response Measurement mode.

5.1.1 Measurement type

Specific standards developed for noise measurements require system response measurements done both before and after completing Noise measurements on a DUT. Depending on the Measurement type (Before / After) the measured system response data will update the relating table under Setup for each measured channel line:



Individual input channel information such as the measured System frequency response data are found in tables under Setup for each microphone channel. Setup for each microphone channel is located in the last column of the Microphones table.

The system frequency response will determine the difference between the Reference input voltage and the actual measured voltage. The difference in voltage is scaled to dB and expressed in 1/3 octave bands.

The Correction column will have a:

- yellow - background color if the 'Before - after max difference' for system response difference is exceeded
- green - background color if the max difference is not exceeded.

The parameter 'Before - after max difference' for system response difference can be changed under the module's extension settings. Please see the section Module extension settings for more information.

5.1.2 Threshold

The Threshold level determines the trigger level for when the System frequency response measurement will begin. If the measured generator source signal level exceeds the user-defined Threshold level, then

the system response measurement will begin. All measurements are performed under the Measure tab section.

5.1.3 Averaging time

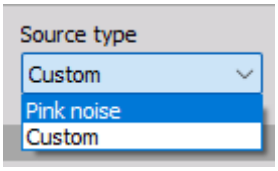
The Averaging time determines the used measurement duration for the results. For example, if set to 5 sec then 5 sec duration of data are used and averaged together, starting from the time point that channel level was exceeding the Threshold level.

5.1.4 Ref. frequency

The Reference frequency is the frequency for which the level is used as the basis for when compared to other frequency levels. The level differences are the values that you will see for the specific microphone channel under the setup screen for that, under the tabs System response [before] and [after].

5.1.5 Source type

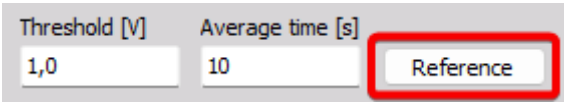
The Source type defines the used generator excitation signal type that are send into the microphone cable.



System frequency response generator source types,

- Pink noise - this should be selected if the attached generator source outputs a pink noise signal. With pink noise all 1/3-octave band levels are equal and therefore there is no Reference settings available for that type.
- Custom - this should be selected if the attached generator source outputs a custom but known signal type. The known signal type must then be defined under the Reference settings button.

For the Custom Source type, the Reference voltage can be set by clicking on the Reference button under the General System frequency response group of parameters:



Custom Source type Reference settings.

The Reference voltage values can be set for user-specified frequencies and must be set accordingly to the signal characteristics outputted by the used reference source unit:

Reference

Reference

Paste Clear

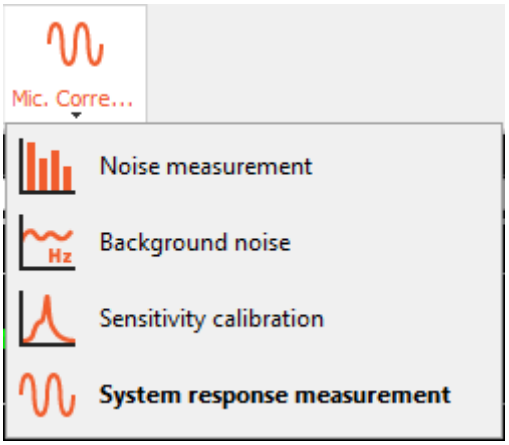
Frequency [Hz]	Reference [V]
20,00	1,00
50,00	1,00
100,00	1,00
200,00	1,00
500,00	1,00
1000,00	1,00
2000,00	1,00
5000,00	1,00
10000,00	1,00
20000,00	1,00

Custom Source type Reference table. Should be set to match the expected source signal characteristics.

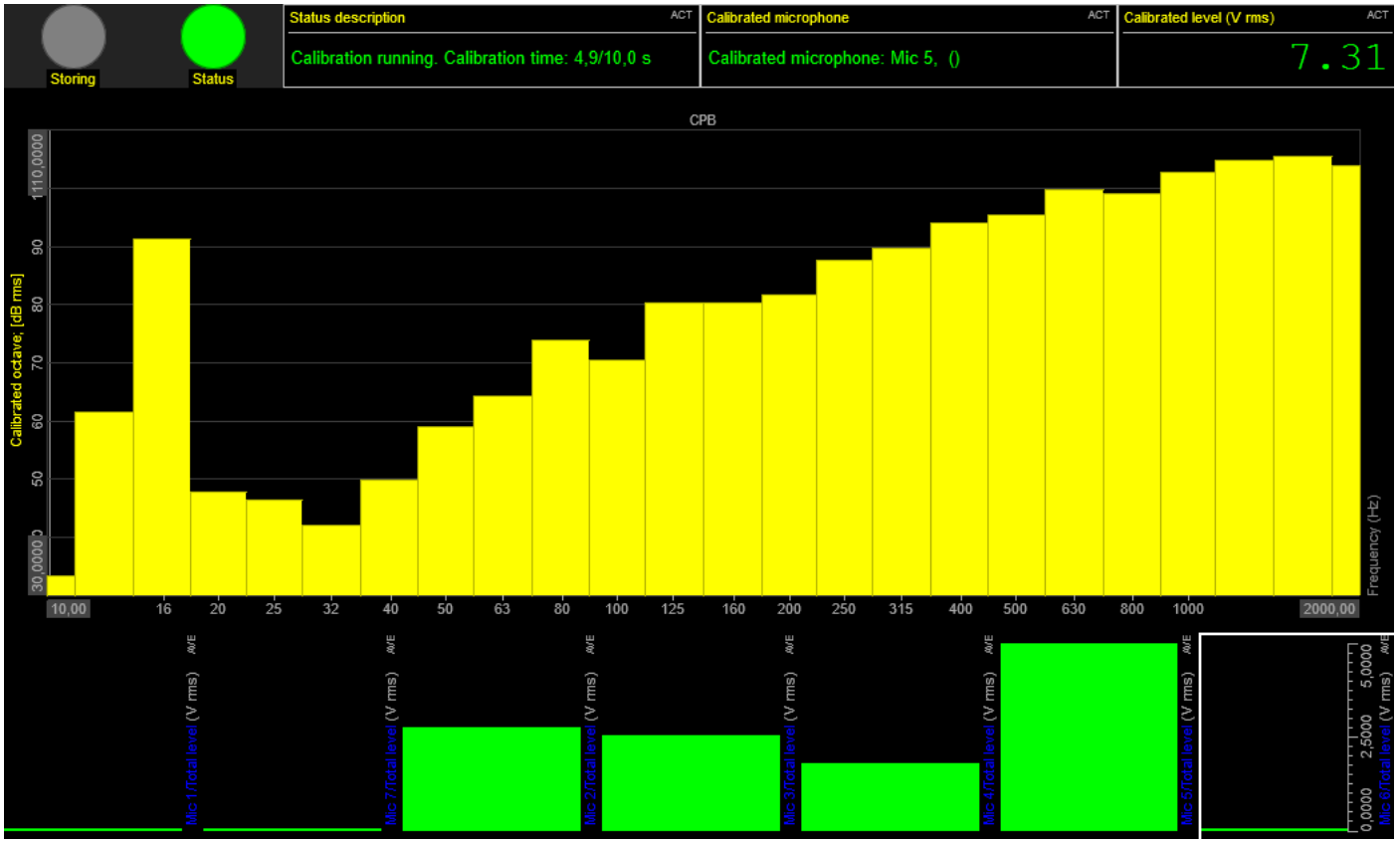
When the reference source unit is turned on and the level is crossing the specified Threshold level then the System response measurement will be activated. While activated 1/3 octave band levels will be averaged over the specified Average time.

Note: You need to go to Measure before measurements will be activated.

The System response measurement can be monitored with the System frequency response sub-display found under the pre-defined MC (Microphone Correction) display templates:

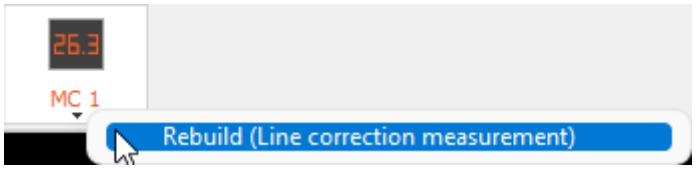


Pre-defined display layouts are found for each Measurement mode under Measure.



System frequency response Pre-defined display layout found under Measure.

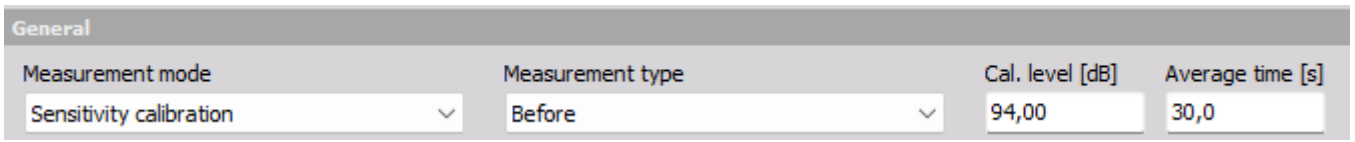
Later on, if the number of microphones used in the test configuration is changed in the setup, then you should update the pre-defined display layout to match the new configuration. This is done by right-clicking and pressing Rebuild on the display layout button relating to the Microphone correction module.



Rebuild the pre-defined display layout if the number of microphones used are changed.

5.2 Sensitivity calibration

Sensitivity calibration is used to measure and correct for changes in the microphone sensor sensitivity. Sensitivity calibration is also referred to as Acoustical sensitivity. Similar to the System frequency response - Measurement mode, the Sensitivity calibration can be set to Before or After the actual DUT noise measurements by toggling the Measurement type parameter.

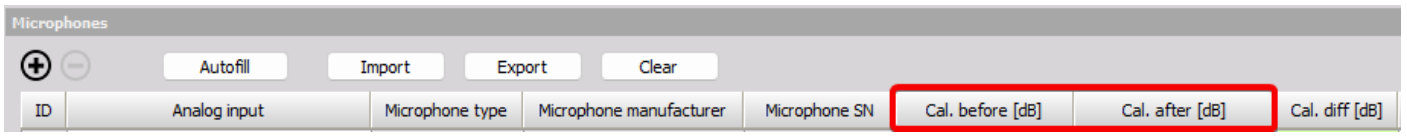


Setup parameters specifically for the Sensitivity calibration Measurement mode.

Note: Sensitivity calibration will use measured System response data such that sensitivity corrections do not get affected by the system line response, but only relates to the actual microphone.

5.2.1 Measurement type

The Measurement type is used similarly for Sensitivity calibration as it is described for the System frequency response mode, but since it is a single value per channel the measured results are shown directly in the Microphones table under the columns Cal. before and Cal. after:

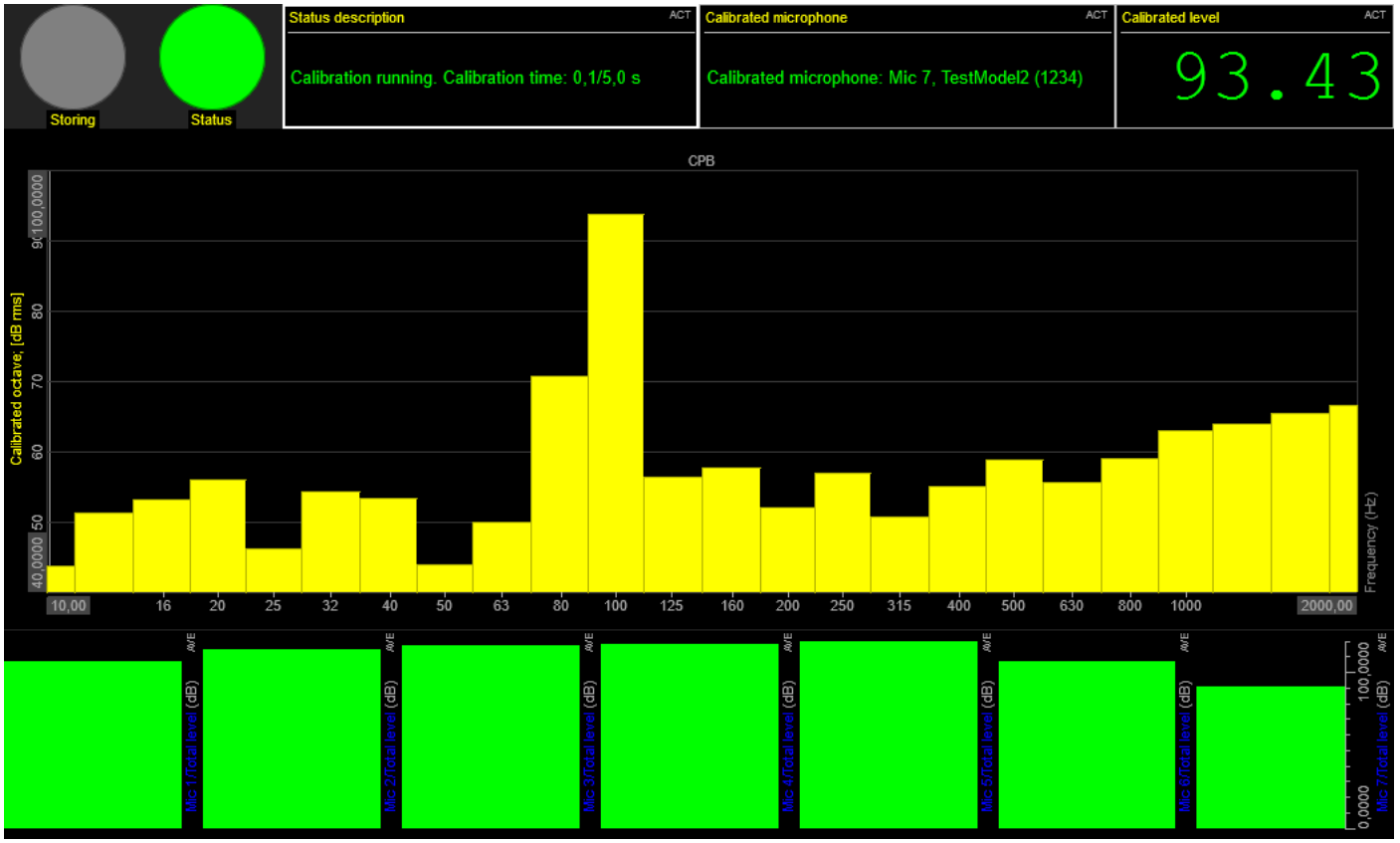


Sensitivity calibration data will be added to the Cal. before and Cal. after columns in the Microphones table for each individual channel.

5.2.2 Calibration level

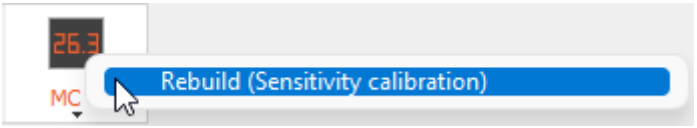
The Sensitivity calibration will start when going to the Measure tab and the Cal. level is detected at one of the microphone inputs. The calibration level should be obtained when a microphone calibrator is mounted on one of the microphones and turned on.

The calibration measurement can be monitored with the Sensitivity calibration sub-display found under the pre-defined MC (Microphone Correction) display templates:



Sensitivity calibration Pre-defined display layout found under Measure.

Later on, if the number of microphones used in the test configuration is changed in the setup, then you should update the pre-defined display layout to match the new configuration. This is done by right-clicking and pressing Rebuild on the display layout button relating to the Microphone correction module.

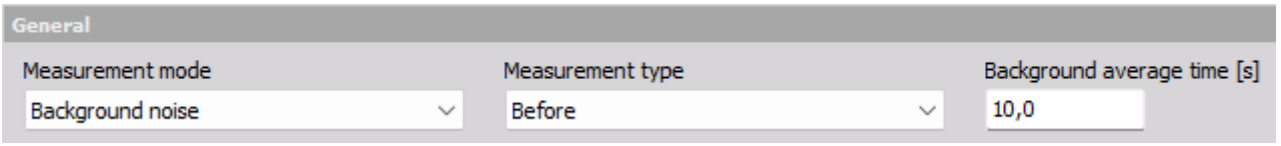


Rebuild the pre-defined display layout if the number of microphones used are changed.

After an active calibrator has been detected the sensitivity calibration will run an averaged measurement over the time duration set by the Average time parameter.
The Status description text field will indicate e.g. if a microphone is being calibrated or if no calibrators have been detected. The Calibrated microphone text field will give information about which microphone that is currently being calibrated.
The octave spectrum in the center and the noise level indicated in the upper right corner will relate to the microphone that is currently being calibrated. The vertical bars level meters at the bottom of the display show the level of all microphone inputs included in the setup.
The Sensitivity calibration results will be visible in the Microphones table under the Cal. before and Cal. after columns. More information can be found under Microphones table - Sensitivity calibration data.

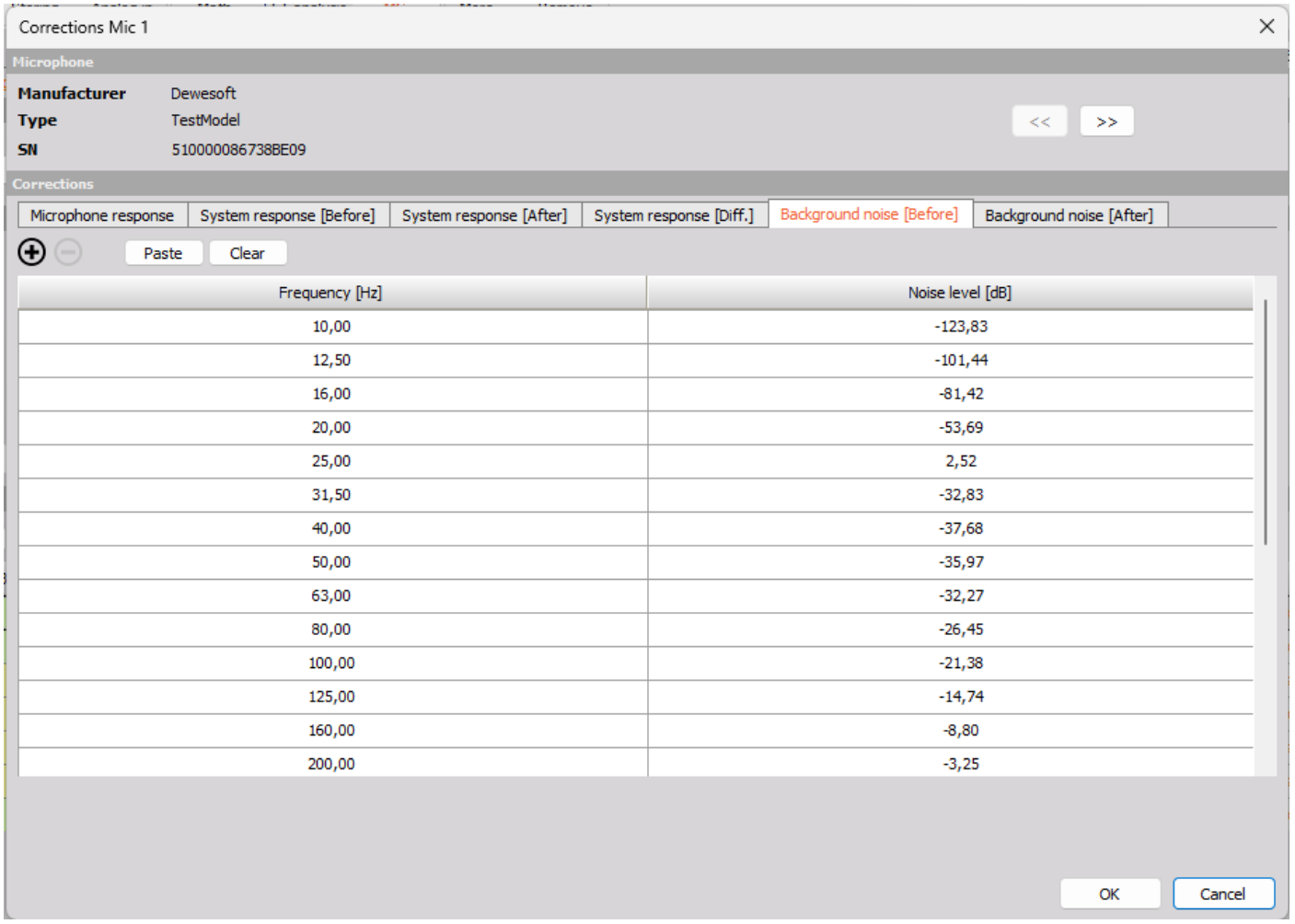
5.3 Background noise

Background noise measurements, also referred to as Ambient noise measurements, can be performed before and after the DUT noise measurement.



Setup parameters specifically for the Background noise Measurement mode.

The Measurement type parameter is used similarly for Background noise measurements as it is described for the System frequency response mode. Measured background noise data will be visible under Setup for the individual channels in the Microphones table.



Frequency [Hz]	Noise level [dB]
10,00	-123,83
12,50	-101,44
16,00	-81,42
20,00	-53,69
25,00	2,52
31,50	-32,83
40,00	-37,68
50,00	-35,97
63,00	-32,27
80,00	-26,45
100,00	-21,38
125,00	-14,74
160,00	-8,80
200,00	-3,25

Measured Background noise data is listed under Setup for the individual channels in the Microphones table.

Under the Measure tab a related pre-defined sub-display layout is available for the Background noise Measurement mode:

Pre-defined Measure display layout made for the Background noise measurement procedure.

5.4 Noise measurement

The Noise measurement mode must be selected to start the actual DUT noise measurements that will have the system- and microphone corrections applied to it, together with a list of other optional corrections. All corrections that should be taken into account can be selected under the Applied corrections section.

Noise measurement should be selected after the required workflow of Before-measurements have been performed, by using the other Measurement modes.

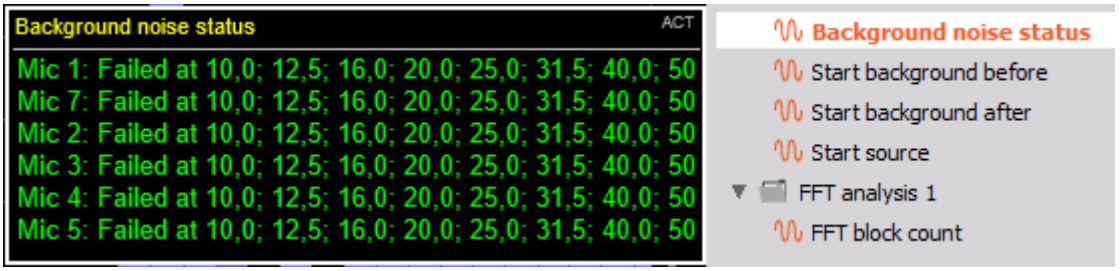
The DUT noise measurement can be managed via the related Measure sub-display.

Pre-defined Measure display layout made for the DUT Noise measurement procedure.

At the Measure tab the pre-defined Noise measurements sub-display (under MC 1) should be used to perform the DUT noise measurements.

The display layout shows 2D graph widgets plotting 1/3-octave band spectra for all included microphones, and a status read-out indicating if the measured levels are too close to the pre-measured background noise levels.

The channel 'Background noise status' is shown with a Digital meter display widget, where the 1/3 octave bands are shown for those where the background noise levels are exceeding the tolerance level set under the module's extension settings:



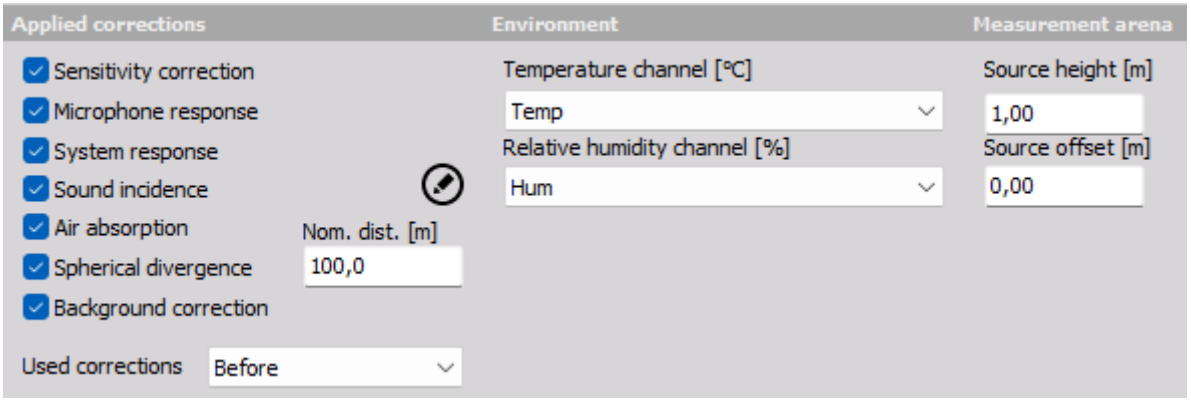
Indicating if the differences between the DUT noise octave levels and the background noise octave levels are not high enough.

Please see the section Extension settings for more information.

Both the Background noise before and -after, and the 'DUT' Source noise are 1/3-octave band spectra which can be overlayed in a 2D graph display widget in order to overview and compare the DUT noise with the background noise.

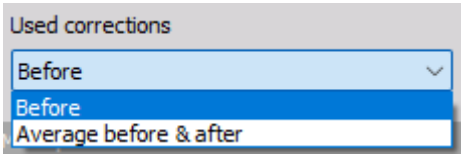
6. Applied corrections

When the Measurement mode 'Noise measurement' is selected under Ch. setup a list of different corrections can be checked On or Off, to be applied to the DUT noise measurements.



List of corrections that can be applied to the DUT noise measurements.

A subset of the available corrections has correction data from both before and after the DUT noise measurements. You can choose between using the correction data from Before the DUT measurements or Averaged correction data between before and after the DUT measurements:



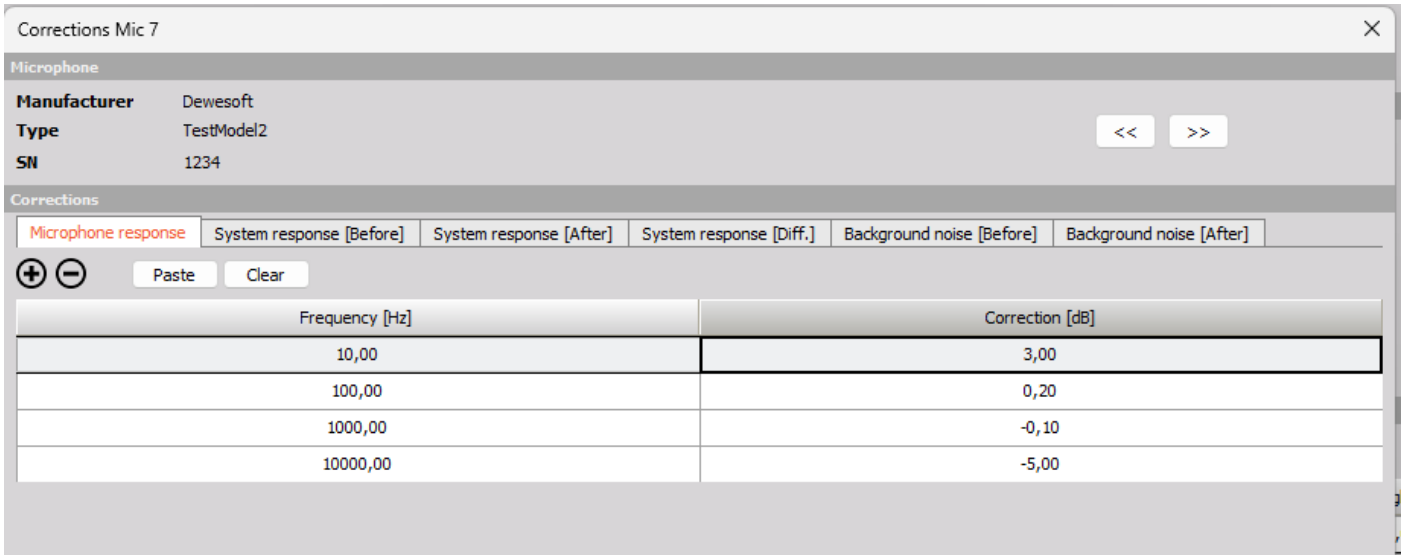
Select which of the correction data to use for the applied correction types that have data from both before and after the noise measurements.

6.1. Sensitivity correction

The sensitivity correction will apply a microphone calibration correction using the measured calibration data from the Sensitivity calibration Measurement mode.

6.2 Microphone response

The microphone response correction will deal with influences of the microphone itself. Open circuit microphone response curve data can be added manually or copy/paste into the related table found under setup for the individual microphones:



The microphone response curve data can be managed in the Microphone response tab under Setup for the individual channels in the Microphones table.

The open circuit microphone response data is typically provided with the microphones from the manufacturer.

6.3 System response

By enabling the correction for the System response, all influences measured in the System frequency response Measurement mode will be taken into account.
The System response results can be found for the individual microphones under the setup buttons in the Microphones table.

6.4 Sound incidence

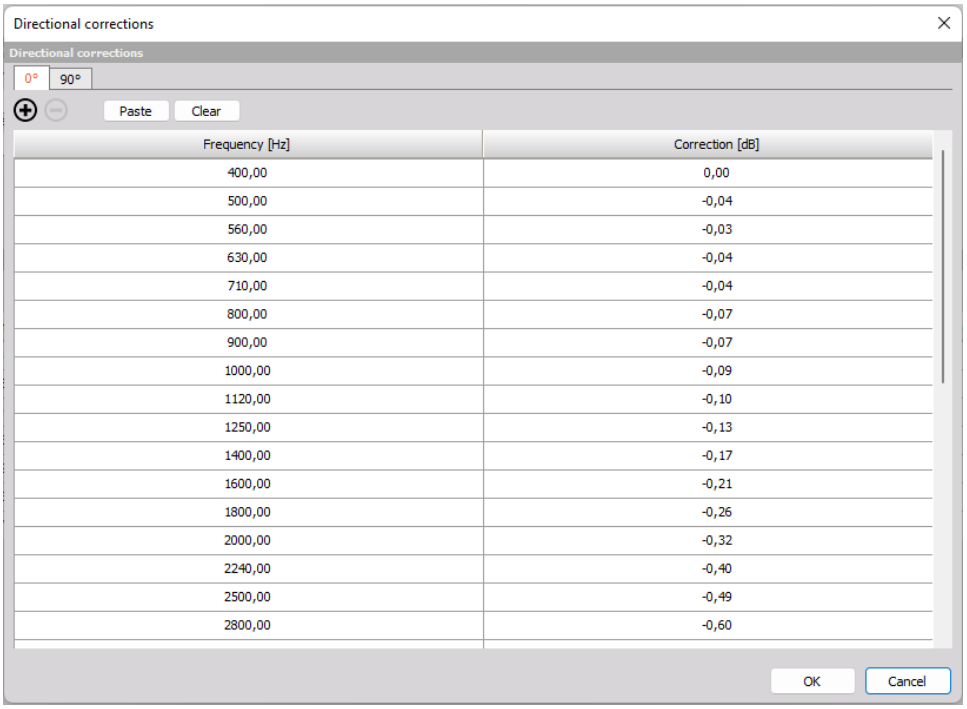
Microphones will typically have a free-field response curve that varies with incidence angle of the received noise. By enabling this correction the DUT noise measurements will be corrected for the different microphone incidence angles used.

The individual microphone incidence angles can be set in the Microphones table under the column 'Incidence'.

The different incidence angle-dependent response curves can be edited by entering the Directional corrections setup, by pressing the pencil button shown below:

Correction data for different incidence angles can be managed by pressing the pencil button.

The Directional corrections setup contains a tab for each Incidence angle available to choose for the individual microphones in the Microphones table.

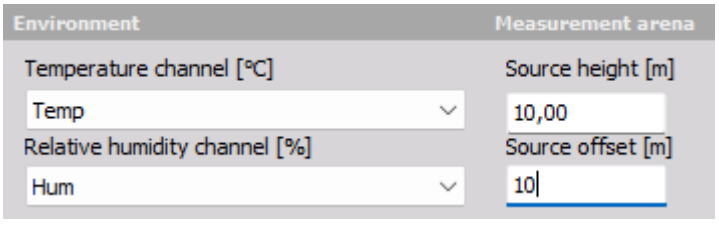


Correction data for multiple incidence angles can be managed in the Directional corrections table found by clicking the pencil button next to Sound incidence.

6.5 Air absorption

The air in the atmosphere will absorb some of the noise energy. How much energy that will be absorbed depends on the temperature and humidity of the air together with the distance between the DUT noise source and a specific microphone position.

Additional input parameters are available under the Environment and Measurement area sections which are used to determine such air absorption data for the microphone locations:



Settings relating to the Air absorption correction.

For the temperature and humidity parameters you must select an input channel.
The temperature channel must have the unit degrees celsius and the humidity channel must have the unit percent.

To determine the distances between the DUT and the individual microphones both the DUT source position and the microphone positions are used. The DUT source position is determined with the Measurement area parameters.

The Source offset relates to the distance between the DUT physical center and the actual/principal DUT noise source. This is illustrated in the setup drawing in the beginning of this manual.
The microphone positions are managed in the Microphones table where the Distance column shows the determined distances between the microphones and the DUT principal noise source.

6.6 Spherical divergence

The Spherical divergence correction will adjust the sound pressure to relate to a nominal distance from the DUT.
By assuming an attenuation rate given by:

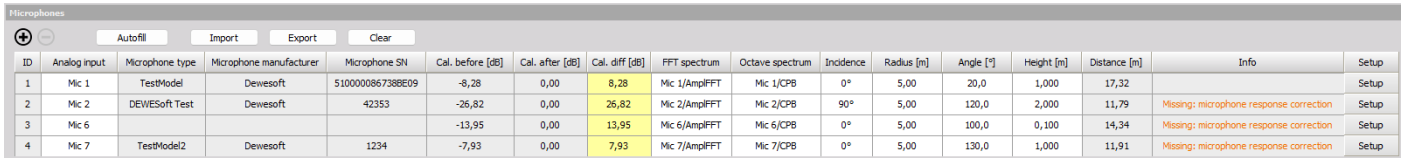
$$\frac{1}{\text{distance}^2},$$

distances different from the nominal distance will be corrected accordingly.

For example if the nominal distance was set to 1 m and the actual distance was 2 m then the adjustment would be +6 dB.
The nominal distance for the spherical divergence can be set using the related Nom. dist. parameter.

7. Microphones table

The Microphones table contains all microphone correction settings that relate to individual microphones.
Additionally, correction data for a given microphone channel are available by clicking the related Setup button in the microphone table row.

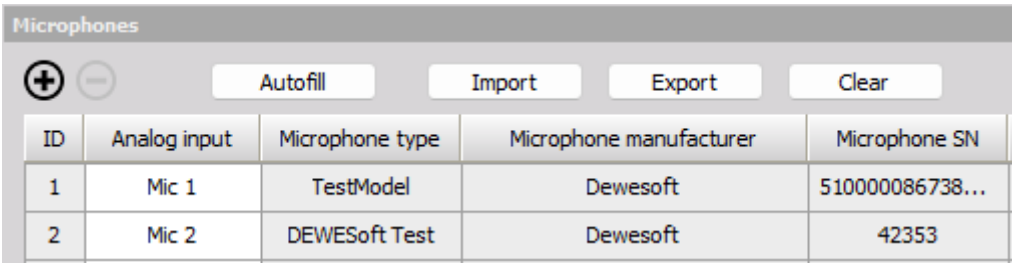


ID	Analog input	Microphone type	Microphone manufacturer	Microphone SN	Cal. before [dB]	Cal. after [dB]	Cal. diff [dB]	FFT spectrum	Octave spectrum	Incidence	Radius [m]	Angle [°]	Height [m]	Distance [m]	Info	Setup
1	Mic 1	TestModel	Dewesoft	510000086738E09	-8,28	0,00	8,28	Mic 1/AmplFFT	Mic 1/CPB	0°	5,00	20,0	1,000	17,32		Setup
2	Mic 2	DEWESoft Test	Dewesoft	42353	-26,82	0,00	26,82	Mic 2/AmplFFT	Mic 2/CPB	90°	5,00	120,0	2,000	11,79	Missing: microphone response correction	Setup
3	Mic 6				-13,95	0,00	13,95	Mic 6/AmplFFT	Mic 6/CPB	0°	5,00	100,0	0,100	14,34	Missing: microphone response correction	Setup
4	Mic 7	TestModel2	Dewesoft	1234	-7,93	0,00	7,93	Mic 7/AmplFFT	Mic 7/CPB	0°	5,00	130,0	1,000	11,91	Missing: microphone response correction	Setup

Illustration of the Microphones table.

7.1 Adding microphones

First, microphones must be added to the Microphones table. This can be done either manually by clicking on the + button and selecting a microphone under the Analog input table column, or it can be done automatically by clicking the Autofill button.



ID	Analog input	Microphone type	Microphone manufacturer	Microphone SN
1	Mic 1	TestModel	Dewesoft	510000086738...
2	Mic 2	DEWESoft Test	Dewesoft	42353

Microphones can be added manually by or automatically using the shown buttons.

7.1.1 Autofill

The Autofill button will add a row in the table for each Used Analog input that has Sound pressure as its Physical quantity.

Using Autofill will add the Microphone Type, Manufacturer, and Serial number, found from the Analog input Setup to the table rows as shown in the picture above. More information about setting up the Analog inputs can be found online here: Analog input Setup.

If FFT and Octave analyzers are processing the microphone channel data then those output spectra will also be added to the spectrum related table columns:

FFT spectrum	Octave spectrum
Mic 1/AmplFFT	Mic 1/CPB
Mic 7/AmplFFT	Mic 7/CPB

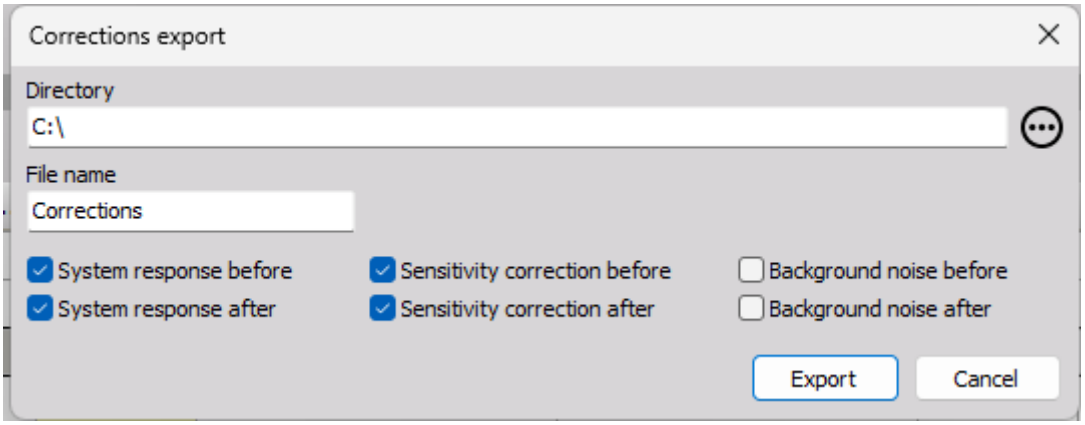
Showing the columns in the Microphones table that handles related FFT and Octave analyzer data.

7.2 Import / Export correction data

The Import and Export buttons located over the Microphones table next to Autofill button, can be used to export or import microphone correction data to or from the table.

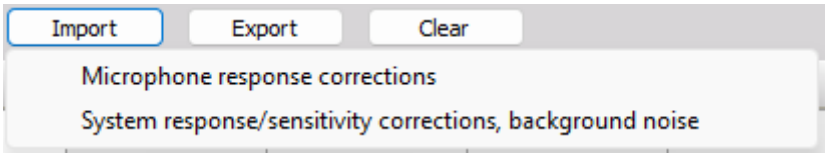
Export and import measured microphone correction data using the shown buttons.

Clicking on the Export button will open settings for what to export and to what Directory:



Clicking the Export button above the Microphones table will open a window that shows the Export options

Each microphone channel (table row) will be exported to a separate TXT file. Each channel TXT file will include information about the Microphone Type and Serial number, together with the data that has been selected to be exported via the check boxes.
Clicking on the Import button let you import microphone response data or system response data together with sensitivity correction data and background noise data:



Clicking the Import button above the Microphones table let you select what type of microphone data to import.

7.3 Sensitivity calibration data

The table columns Cal. before and Cal. after are showing the measured Sensitivity calibration results. See more about how to obtain such calibration sensitivity results under the section Measurement mode - Sensitivity calibration.

Cal. before [dB]	Cal. after [dB]	Cal. diff [dB]
-6,21	-4,25	1,97
-3,00	-1,43	1,57
-23,15	-24,64	1,49
-34,72	-25,50	9,22
-48,05	-47,62	0,43
-4,66	-4,78	0,13

Measured Sensitivity calibration data are listed in the Microphones table in the illustrated columns.

The column Cal. diff shows the Cal. after value minus the Cal. before value, and will have a:

- yellow - background color if the 'Before - after max difference' for Microphone sensitivity correction is exceeded
- green - background color if the max difference is not exceeded.

The parameter 'Before - after max difference' for Microphone sensitivity corrections can be changed under the module's Extension settings.

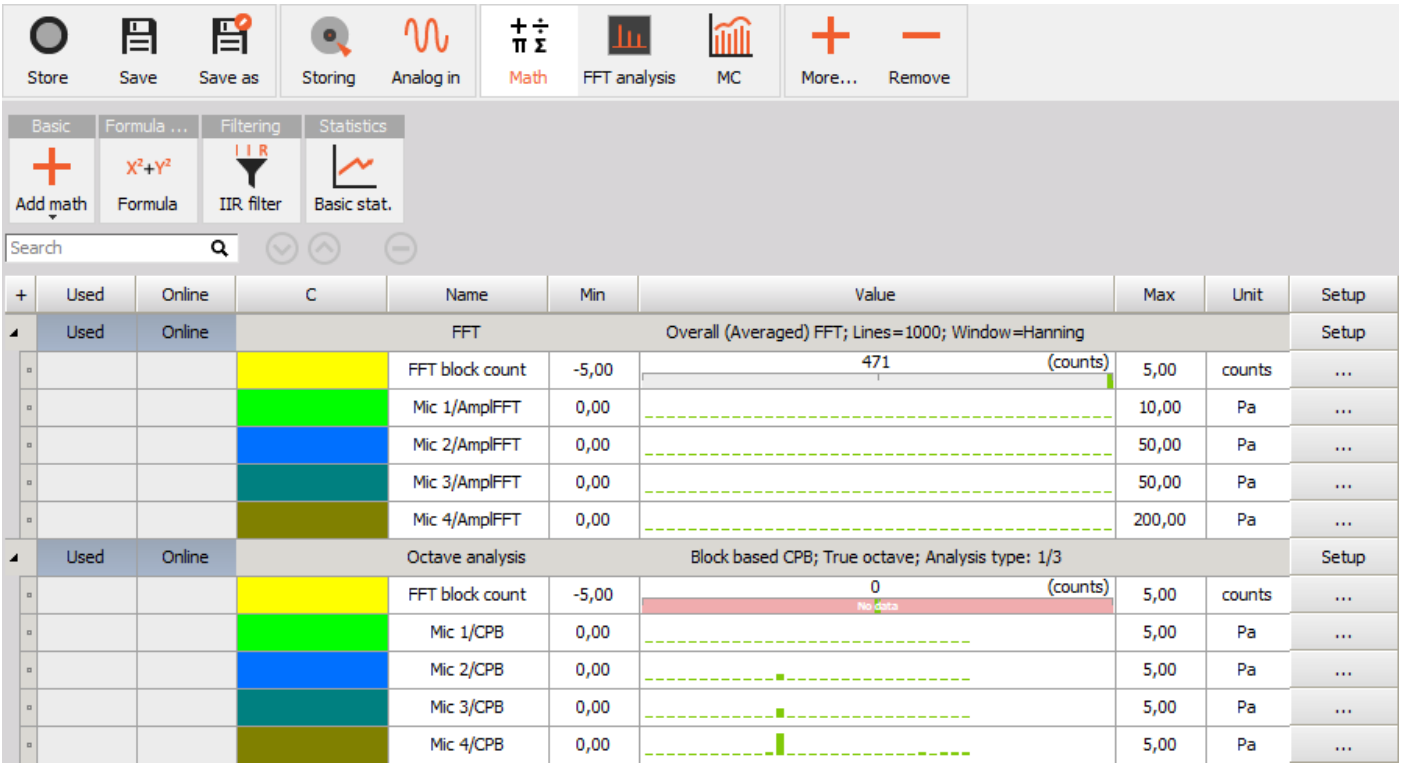
7.4 Spectral data

The columns FFT spectrum and Octave spectrum will use all enabled Applied corrections:

FFT spectrum	Octave spectrum
Mic 1/AmplFFT	Mic 1/CPB
Mic 7/AmplFFT	Mic 7/CPB
Mic 2/AmplFFT	Mic 2/CPB
Mic 3/AmplFFT	Mic 3/CPB

Derived, corrected spectral channels will be created based on the related FFT and Octave spectral channels that are selected.

FFT and Octave analysis math modules must be set up to process the microphone channels before such related spectra can be selected in the columns:



+	Used	Online	C	Name	Min	Value	Max	Unit	Setup
◢	Used	Online		FFT		Overall (Averaged) FFT; Lines=1000; Window=Hanning			Setup
				FFT block count	-5,00	471 (counts)	5,00	counts	...
				Mic 1/AmplFFT	0,00		10,00	Pa	...
				Mic 2/AmplFFT	0,00		50,00	Pa	...
				Mic 3/AmplFFT	0,00		50,00	Pa	...
				Mic 4/AmplFFT	0,00		200,00	Pa	...
◢	Used	Online		Octave analysis		Block based CPB; True octave; Analysis type: 1/3			Setup
				FFT block count	-5,00	0 (counts) No data	5,00	counts	...
				Mic 1/CPB	0,00		5,00	Pa	...
				Mic 2/CPB	0,00		5,00	Pa	...
				Mic 3/CPB	0,00		5,00	Pa	...
				Mic 4/CPB	0,00		5,00	Pa	...

FFT and octave math data of the microphones which can be corrected with the Microphone Correction module.

The picture above shows the Math setup tab with an FFT analyzer module and an Octave analyzer module having a set of microphone channels added for processing.
The output spectral channels from these analysis modules can be added for applying corrections in the Microphones table for the FFT spectrum and Octave spectrum columns.

Hereafter, on the Measure tab you will be able to select and compare spectral data with and without corrections applied - those directly from the FFT and octave modules and those that have been processed further in the Microphone correction module:

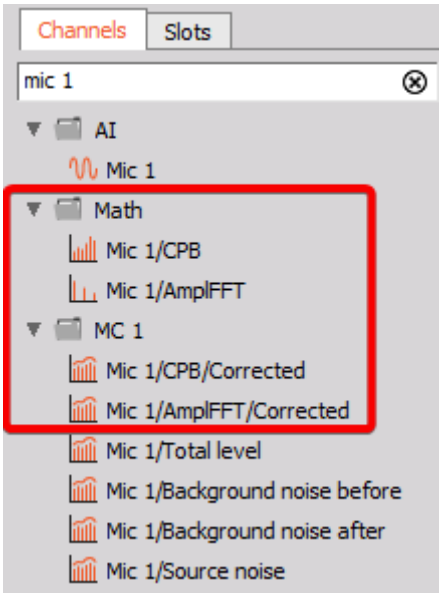
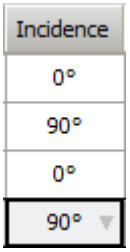


Illustration of the used spectral Math data channels and the produced corrected MC spectral data channels.

7.5 Incidence angle

The Incidence angle of each microphone can be set to one of the pre-defined angles specified under the Applied corrections - Sound incidence settings:



The microphone incidence angle can be set to one of the defined angles from the Sound incidence settings.

The incidence angle should be set relative to the direction line between the microphone and the principal DUT noise source location, as illustrated in the sketched picture under the Introduction section.

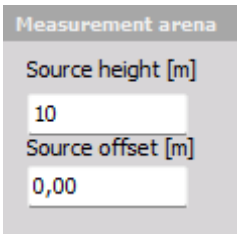
7.6 Location and distance to DUT

The location of the microphones are defined with cylindrical coordinates where the DUT noise source is at the circle center. Based on the Radius, Angle, and Height, the location of the microphones are specified by the user.

Radius [m]	Angle [°]	Height [m]	Distance [m]
5,00	30,0	1,000	10,30
6,00	60,0	2,000	10,00
7,00	90,0	4,000	9,22
8,00	120,0	2,000	11,31
9,00	150,0	1,000	12,73
10,00	180,0	0,100	14,07
0,00	0,0	0,000	10,00

Microphone location data relative to the DUT noise source.

The Distance column in the table is determined from the specified microphone location parameters shown above together with the parameters defining the DUT principal noise location as specified under Measurement area parameters and as shown below:



DUT noise source height and offset to the Principal noise source location.

7.7 Information and setup

The microphone table Info column will indicate missing input data required to perform the corrections on DUT noise measurements. Some examples of possible information messages are shown below:

Info	Setup
Missing: line correction, microphone response correction	Setup
Missing: line correction, microphone response correction	Setup
Missing: microphone response correction	Setup
No input channel selected or found	Setup

Examples of messages that help configuring the module settings as intended.

The Setup button for each microphone will open the settings for the microphone Response data and the System response data. These settings are described under the Applied corrections - Microphone response and under Measurement modes - System frequency response.

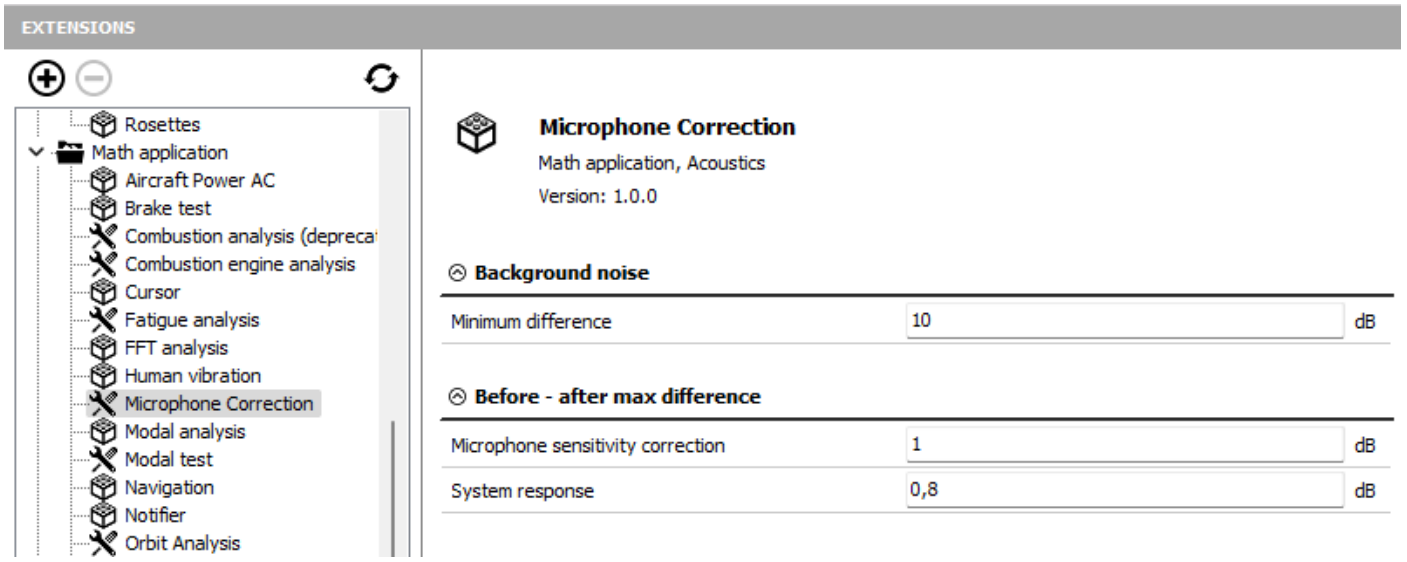
8. Module extension settings

The Microphone correction module's Extensions settings will appear when clicking on the extension settings icon, as shown below. The extension settings icon is found in the top right corner of the module setup:

By clicking the button with the screwdriver and spanner icon you will open up the Extension settings window related to the Microphone correction module.

Alternatively you can click on Options in the top right corner and select Settings, then go to the Extensions tab section and find the Microphone Correction module under Math applications in the list of active modules.

The Extension settings for the module let the user change the level tolerances for the different measurement modes.



Extension settings for the Microphone correction module.

8.1 Background noise tolerance

The Background noise - Minimum difference level is used for the background noise status channel as shown in the section for measurement modes - Noise measurement.

If the DUT Noise measurements and the background noise measurements have 1/3 octave band level differences lower than the set dB level then those bands will be indicated by the Background noise status channel.

8.2 Before - after max difference tolerances

Under ‘Before - after max difference’ you can set tolerance levels used for the two Measurements modes - Sensitivity calibration and System frequency response:

- Microphone sensitivity correction - tolerance will be used to determine the background color in the Microphones table - Sensitivity calibration data.
- System response difference - tolerance will be used to determine the background color for the System response data.

9. Warranty information

Notice
The information contained in this document is subject to change without notice.

Note:
Dewesoft d.o.o. shall not be liable for any errors contained in this document. Dewesoft MAKES NO WARRANTIES OF ANY KIND WITH REGARD TO THIS DOCUMENT, WHETHER EXPRESS OR IMPLIED. DEWESOFT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. Dewesoft shall not be liable for any direct, indirect, special, incidental, or consequential damages, whether based on contract, tort, or any other legal theory, in connection with the furnishing of this document or the use of the information in this document.

The copy of the specific warranty terms applicable to your Dewesoft product and replacement parts can be obtained from your local sales and service office. To find a local dealer for your country, please visit https://dewesoft.com/support/distributors.

9.1 Calibration

Every instrument needs to be calibrated at regular intervals. The standard norm across nearly every industry is annual calibration. Before your Dewesoft data acquisition system is delivered, it is calibrated. Detailed calibration reports for your Dewesoft system can be requested. We retain them for at least one year, after system delivery.

9.2 Support

Dewesoft has a team of people ready to assist you if you have any questions or any technical difficulties regarding the system. For any support please contact your local distributor first or Dewesoft directly.

Dewesoft d.o.o.
Gabrsko 11a
1420 Trbovlje Slovenia

Europe Tel.: +386 356 25 300
Web: http://www.dewesoft.com
Email: Support@dewesoft.com
The telephone hotline is available Monday to Friday from 07:00 to 16:00 CET (GMT +1:00)

9.3 Service/repair

The team of Dewesoft also performs any kinds of repairs to your system to assure a safe and proper operation in the future. For information regarding service and repairs please contact your local distributor first or Dewesoft directly on https://dewesoft.com/support/rma-service.

9.4 Restricted Rights

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10. Safety instructions

Your safety is our primary concern! Please be safe!

10.1 Safety symbols in the manual

Warning
Calls attention to a procedure, practice, or condition that could cause the body injury or death

Caution
Calls attention to a procedure, practice, or condition that could possibly cause damage to equipment or permanent loss of data.

10.2 General Safety Instructions

Warning

The following general safety precautions must be observed during all phases of operation, service, and repair of this product. Failure to comply with these precautions or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. Dewesoft d.o.o. assumes no liability for the customer's failure to comply with these requirements.

All accessories shown in this document are available as an option and will not be shipped as standard parts.

10.2.1 Environmental Considerations

Information about the environmental impact of the product.

10.2.2 Product End-of-Life Handling

Observe the following guidelines when recycling a Dewesoft system:

10.2.3 System and Components Recycling

Production of these components required the extraction and use of natural resources. The substances contained in the system could be harmful to your health and to the environment if the system is improperly handled at its end of life! Please recycle this product in an appropriate way to avoid unnecessary pollution of the environment and to keep natural resources.

This symbol indicates that this system complies with the European Union's requirements according to Directive 2002/96/EC on waste electrical and electronic equipment (WEEE). Please find further information about recycling on the Dewesoft web site www.dewesoft.com

Restriction of Hazardous Substances
This product has been classified as Monitoring and Control equipment and is outside the scope of the 2002/95/EC RoHS Directive. However, we take care of our environment and the product is lead-free.

10.2.4 General safety and hazard warnings for all Dewesoft systems

Safety of the operator and the unit depend on following these rules.

- Use this system under the terms of the specifications only to avoid any possible danger.
- Read your manual before operating the system.
- Observe local laws when using the instrument.
- DO NOT touch internal wiring!
- DO NOT use higher supply voltage than specified!
- Use only original plugs and cables for harnessing.
- You may not connect higher voltages than rated to any connectors.
- The power cable and connector serve as Power-Breaker. The cable must not exceed 3 meters, the disconnect function must be possible without tools.
- Maintenance must be executed by qualified staff only.
- During the use of the system, it might be possible to access other parts of a more comprehensive system. Please read and follow the safety instructions provided in the manuals of all other components regarding warning and security advice for using the system.
- With this product, only use the power cable delivered or defined for the host country.
- DO NOT connect or disconnect sensors, probes or test leads, as these parts are connected to a voltage supply unit.
- Ground the equipment: For Safety Class 1 equipment (equipment having a protective earth terminal), a non-interruptible safety earth ground must be provided from the mains power source to the product input wiring terminals.
- Please note the characteristics and indicators on the system to avoid fire or electric shocks. Before connecting the system, please read the corresponding specifications in the product manual carefully.
- The inputs must not, unless otherwise noted (CATx identification), be connected to the main circuit of category II, III and IV.
- The power cord separates the system from the power supply. Do not block the power cord, since it has to be accessible for the users.
- DO NOT use the system if equipment covers or shields are removed.
- If you assume the system is damaged, get it examined by authorized personnel only.
- Adverse environmental conditions are Moisture or high humidity Dust, flammable gases, fumes or dissolver Thunderstorm or thunderstorm conditions (except assembly PNA) Electrostatic fields, etc.
- The measurement category can be adjusted depending on module configuration.
- Any other use than described above may damage your system and is attended with dangers like short-circuiting, fire or electric shocks.
- The whole system must not be changed, rebuilt or opened.
- DO NOT operate damaged equipment: Whenever it is possible that the safety protection features built into this product have been impaired, either through physical damage, excessive moisture,

or any other reason, REMOVE POWER and do not use the product until the safe operation can be verified by service-trained personnel. If necessary, return the product to Dewesoft sales and service office for service and repair to ensure that safety features are maintained.

- If you assume a more riskless use is not provided anymore, the system has to be rendered inoperative and should be protected against inadvertent operation. It is assumed that a more riskless operation is not possible anymore if the system is damaged obviously or causes strange noises. The system does not work anymore. The system has been exposed to long storage in adverse environments. The system has been exposed to heavy shipment strain.
- Warranty void if damages caused by disregarding this manual. For consequential damages, NO liability will be assumed!
- Warranty void if damage to property or persons caused by improper use or disregarding the safety instructions.
- Unauthorized changing or rebuilding the system is prohibited due to safety and permission reasons (CE).
- Be careful with voltages >25 VAC or >35 VDC! These voltages are already high enough in order to get a perilous electric shock by touching the wiring.
- The product heats during operation. Make sure there is adequate ventilation. Ventilation slots must not be covered!
- Only fuses of the specified type and nominal current may be used. The use of patched fuses is prohibited.
- Prevent using metal bare wires! Risk of short circuit and fire hazard!
- DO NOT use the system before, during or shortly after a thunderstorm (risk of lightning and high energy over-voltage). An advanced range of application under certain conditions is allowed with therefore designed products only. For details please refer to the specifications.
- Make sure that your hands, shoes, clothes, the floor, the system or measuring leads, integrated circuits and so on, are dry.
- DO NOT use the system in rooms with flammable gases, fumes or dust or in adverse environmental conditions.
- Avoid operation in the immediate vicinity of high magnetic or electromagnetic fields, transmitting antennas or high-frequency generators, for exact values please refer to enclosed specifications.
- Use measurement leads or measurement accessories aligned with the specification of the system only. Fire hazard in case of overload!
- Lithium ion batteries are classified as not hazardous when used according to the recommendations of the manufacturer described in Battery Safety Data Sheet, which is available for download from this link.
- Do not switch on the system after transporting it from a cold into a warm room and vice versa. The thereby created condensation may damage your system. Acclimatise the system unpowered to room temperature.
- Do not disassemble the system! There is a high risk of getting a perilous electric shock. Capacitors still might be charged, even if the system has been removed from the power supply.
- The electrical installations and equipment in industrial facilities must be observed by the security regulations and insurance institutions.
- The use of the measuring system in schools and other training facilities must be observed by skilled personnel.
- The measuring systems are not designed for use in humans and animals.
- Please contact a professional if you have doubts about the method of operation, safety or the connection of the system.

- Please be careful with the product. Shocks, hits and dropping it from already- lower level may damage your system.
- Please also consider the detailed technical reference manual as well as the security advice of the connected systems.
- This product has left the factory in safety-related flawlessness and in proper condition. In order to maintain this condition and guarantee safety use, the user has to consider the security advice and warnings in this manual.

EN 61326-3-1:2008
IEC 61326-1 applies to this part of IEC 61326 but is limited to systems and equipment for industrial applications intended to perform safety functions as defined in IEC 61508 with SIL 1-3.

The electromagnetic environments encompassed by this product family standard are industrial, both indoor and outdoor, as described for industrial locations in IEC 61000-6-2 or defined in 3.7 of IEC 61326-1.

Equipment and systems intended for use in other electromagnetic environments, for example, in the process industry or in environments with potentially explosive atmospheres, are excluded from the scope of this product family standard, IEC 61326-3-1.

Devices and systems according to IEC 61508 or IEC 61511 which are considered as “operationally well-tried”, are excluded from the scope of IEC 61326-3-1.

Fire-alarm and safety-alarm systems, intended for the protection of buildings, are excluded from the scope of IEC 61326-3-1.

11. Documentation version history

Version	Date	Notes
V23-1	2023-05-30	First version of the manual