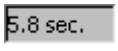
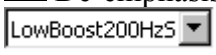
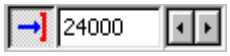
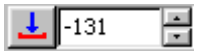
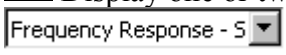
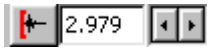
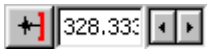
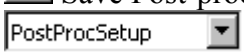
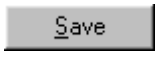
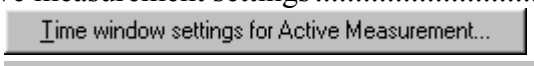
1 File 6
1.1 New Group 6
1.2 Insert in Active Group... 6
1.3 Open Group... 6
1.3.1 Browser: Open 7
1.4 Close 8
1.5 Save Active Measurement As... 8
1.5.1 Browser for saving 1-channel measurement 8
1.5.2 Browser for saving 2-channel Measurement 9
1.6 Save Active Measurement 9
1.6.1 As Measurement System Correction File 9
1.6.2 With Filename <_ActiveMeas_> 10
1.7 Save Data in Active Plot As... 10
1.8 Save Active Plot As... 10
1.9 Print Active Plot 11
1.10 Print Preview Active Plot... 11
1.11 Convert Measurement(s)... 12
1.12 Exit 12
2 Edit 12
2.1 Copy to clipboard 12
3 View 13
3.1 Volume and Input Level(s) Dialog 13
3.2 Measurement Selection Toolbar 14
3.2.1 MLS Measurement mode 14
3.2.1.1 MLS 15
3.2.1.2 MLS (scope) 15
3.2.1.3 No excitation (scope) 15
3.2.1.4 Trigged, no excitation (scope) 15
3.2.1.5 Sinusoid (scope) 15
3.2.1.6 Excitation from text file 15
3.2.2 Delete unplotted measurements from memory 15
3.2.3 ...\Studios\Studio1.wmb Active measurement in upper plot 15
3.2.4 Update both plots with the same measurement 15
3.2.5 ...\ConcertHall\fig8.wav Measurement in lower plot or reference measurement ... 16
3.2.6 Select “lower plot measurement” or “reference measurement” in combo box 16
3.3 Measurement Settings Toolbar 16
3.3.1 1 ch. Number of Channels to Measure 16
3.3.2 48000 Sampling Frequency 16
3.3.3 14 Sequence Order 17
3.3.4 0.341 sec. Length of Measured Data 17

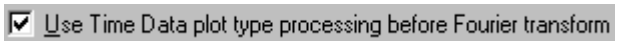
3.3.5  Number of Averages 17
3.3.6  Total Meas. Time 17
3.3.7  Number of sequences to pre-send 18
3.3.8  Sequence Type 18
3.3.9  Measurement System Correction 18
3.3.10  Pre-emphasis 18
3.3.11  De-emphasis 19
3.3.12  Type of emphasis 19
3.4 List of Curves Toolbar 19
3.4.1 Deleting curve(s) from the plot 19
3.4.2 Dragging curves to change the order 19
3.4.3  Change curve type 19
3.4.4  Display the curve 20
3.4.5 Change the curve color 20
3.5 Plot Toolbar 20
3.5.1  Setting the lower x-axis limit 20
3.5.2  Setting the upper x-axis limit 20
3.5.3  Setting the lower y-axis limit 21
3.5.4  Setting the upper y-axis limit 21
3.5.5  Auto-scale the plot in all directions 21
3.5.6  Display one or two plots in the window 21
3.5.7  Selecting Plot Type in Active Plot 22
3.5.8  Settings for the Active Plot 22
3.6 Frequency Plots Toolbar 22
3.7 Time Window Toolbar 23
3.7.1  Setting the lower window limit 24
3.7.2  Setting the upper window limit 24
3.7.3  Window length 24
3.7.4  Window x-axis unit 24
3.7.5  Time data window type 24
3.7.6  Display time window in time data plot type 24
3.8 Setups Toolbar 24
3.8.1  Select a new Measurement Setup 25
3.8.2  Save Measurement Setup 25
3.8.3  Save Post-processing Setup when Measurement Setup is saved 25
3.8.4  Select a new Post-processing Setup 25
3.8.5  Save Measurement Setup 25

3.9 Standard Toolbar 25
3.10 Status Bar 27
3.10.1 Status bar during a measurement 27
4 Measurement 27
4.1 Start Measurement  28
4.2 Cancel Measurement  28
4.3 Test Current Levels 28
4.4 Set Input Volume(s) 28
4.5 Set Output Volume 28
4.6 Measurement Information… 28
4.7 Delete Unplotted Measurements  29
4.8 Sound Card Settings 29
4.8.1 Mixer and Synchronization Settings 30
4.8.1.1 Synchronization Mode – Measurement of initial time delay, or not. 30
4.8.1.2 Loop-back settings 32
4.8.2 Input Settings 33
4.8.3 Output Settings 33
4.8.4 Sound Card Specific Settings 34
4.8.5 Advanced settings 35
4.9 Hardware Calibration… 35
4.9.1 Absolute Input Level Calibration 36
4.9.1.1 General settings 37
4.9.1.2 Total calibration 37
4.9.1.3 Detailed Calibration 38
4.9.2 Absolute output level calibration 39
4.9.3 Relative calibration of mixer input 39
4.9.4 Relative calibration of mixer output 40
4.9.5 Measurement System Correction 40
4.10 Measurement Settings Toolbar 40
4.11 Sinusoid Settings… 40
4.12 Advanced Settings 41
4.12.1 Pre-D/A sound card output amplitude 41
4.12.2 Emphasis offset 42
4.12.3 Limits for automatic setting of volume 42
4.13 Measurement Tasks… 42
4.13.1 Tasks when performing a measurement 43
4.13.2 Tasks when performing or inserting a new measurement from file 44
4.14 Defaults for Saving... 45
4.14.1 Default file-parameters 46
4.14.2 Title and comments 47
4.14.3 Autoname generator 47
4.15 Measurement Setup... 47
4.15.1  Select setup 48
4.15.2  48
4.15.3  Save setup 48

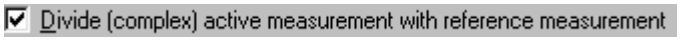
4.15.4 Save As... Save setup as 48
4.15.5 Delete Delete setup 49
4.15.6 Load Load setup 49
4.15.7 Close Close dialog 49
5 Plot 49
5.1 Add Curve(s) 50
5.2 Delete All Curves 50
5.3 Hold plotted curves 50
5.4 Menu: Solo Active Measurement Curve 50
5.5 Auto Refresh 51
5.5.1 Active Measurement 51
5.5.2 All Measurements 51
5.5.3 Off 51
5.6 Refresh Active 52
5.7 Refresh All 52
5.8 Select Plot Type(s)/Measurement(s)... 52
5.8.1 Number of plots 52
5.8.2 Plot Type in Primary (upper) Plot 53
5.8.3 Active measurement in Primary (upper) Plot 53
5.8.4 Plot Type in Secondary (lower) Plot 53
5.8.5 Active measurement in Secondary (lower) Plot 53
5.9 Chart Settings for Active Plot... 53
5.9.1 Chart page 54
5.9.2 Series page 54
5.9.3 Data page 55
5.9.4 Export tab 55
5.9.5 Print tab 56
5.10 Plot Type Settings 56
5.10.1 Time Data… 56
5.10.1.1 X-axis settings 57
5.10.1.2 Y-axis settings 57
5.10.1.3 Y-axis scaling 57
5.10.1.4 Velocity of sound 344 [m/s] 58
5.10.1.5 Show time window for active measurement 58
5.10.1.6 Remove DC-component (0 Hz) 59
5.10.1.7 Processing Type 59
5.10.1.8 Filtering 60
5.10.2 Integrated Time Data (Step Response)... 62
5.10.3 Energy-time Curve 62
5.10.3.1 Frequency domain windowing 63
5.10.4 Schroeder Curve… 64
5.10.4.1 Integration Options 64
5.10.5 Frequency Response/Spectrum 65

5.10.5.1 X-axis settings 65
5.10.5.2 Y-axis settings 65
5.10.5.3 General Frequency Domain Settings 65
5.10.5.4 Type 65
5.10.5.5 Smoothing or Integration 66
5.10.5.6 Guidelines 69
5.10.5.7 Compensation of Magnitude 71
5.10.5.8 Shift/Normalization 71
5.10.6 Phase Frequency Response/Function... 72
5.10.6.1 X-axis settings 73
5.10.6.2 Y-axis settings 73
5.10.6.3 General Frequency Domain Settings 73
5.10.6.4 Phase type 73
5.10.6.5 Smoothing 74
5.10.6.6 Remove delay in frequency range 74
5.10.6.7 Subtract delay 74
5.10.7 Group Delay 74
5.10.7.1 X-axis settings 75
5.10.7.2 Y-axis settings 75
5.10.7.3 General Frequency Domain Settings 75
5.10.7.4 Type 76
5.10.7.5 Smoothing 76
5.10.8 Waterfall 76
5.10.8.1 X-axis settings 77
5.10.8.2 Y-axis settings 77
5.10.8.3 Z-axis settings 77
5.10.8.4 Waterfall layout 78
5.10.8.5 Energy-Time-Frequency (ETF) calculation settings 80
5.10.8.6 Mode 81
5.10.8.7 Cycles 82
5.10.8.8 FFT shift 82
5.10.8.9 Floor 82
5.10.8.10 General Frequency Domain Settings 83
5.10.8.11 Smoothing 83
5.10.8.12 Microphone correction 83
5.10.8.13 Reference 83
5.10.8.14 Shift magnitude 83
5.10.9 Room Ac. Parameters... 83
5.10.9.1 Type 84
5.10.9.2 Plotting dependency on SNR 84
5.10.9.3 Calculation Options 85
5.10.9.4 Parameter Settings 85
5.10.9.5 Display Signal to Noise Ratio (SNR) 85
5.10.10 Levels 85
5.10.10.1 Type of level 86
5.10.10.2 Time Data processing 87
5.10.10.3 1/3 octave frequency range 88

5.11 General Frequency Domain Settings... 88
5.11.1 Active measurement settings 89
5.11.1.1 

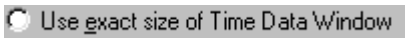
Time window settings 89
5.11.1.2 

91
5.11.1.3 

91
5.11.2 Reference measurement 91
5.11.2.1 

Perform division 91
5.11.2.2 Select reference measurement 92
5.11.2.3 

92
5.11.3 Fourier transform size 92
5.11.3.1 

93
5.11.3.2 

93
5.11.3.3 

93
5.11.3.4 

93
5.11.4 Various 93
5.12 Default Curve Styles 94
5.12.1 Selecting curve color 95
5.12.2 Selecting curve width and style 96
5.12.3 Display curve belonging to active measurement with different width 96
5.12.4 Wrap index 97
5.13 White background on copy/print 97
5.14 Advanced Plot Settings… 97
5.14.1 Add text to Plot 98
5.14.1.1 Add to Title 99
5.14.1.2 Add to Axis Titles 99
5.14.1.3 Add to Footer 100
5.14.2 Various 100
5.14.3 Curve Type and corresponding Chart-file 101
5.14.3.1 Plot type 101
5.14.3.2 Curve type 101
5.14.3.3 Chart-file 103
5.15 Post-Processing Setup 103
5.15.1 

Select setup 104
5.15.2 

Save setup 104
5.15.3 

Save setup as 104
5.15.4 

Delete setup 104
5.15.5 

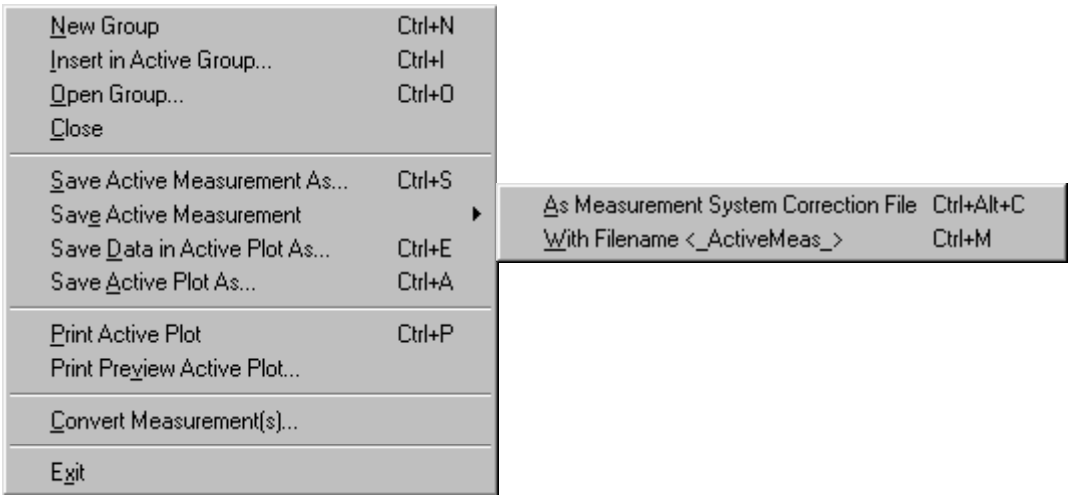
Load setup 104
5.15.6 

Close dialog 104
6 Room Acoustics 104
7 Window 104
8 Help 105
8.1 Help Topics 105

8.2 About WinMLS... 105
8.3 License Options... 106

1 File

Several file operations are accessed via the **File** menu as shown below.



1.1 New Group

Creates a new window displaying one or two plots. It is named *group*, since the window may contain a group of measurements.

1.2 Insert in Active Group...

Inserts measurement file(s) to the active measurement group window. Text-file(s) containing data that is to be plotted may also be inserted. A browser is displayed where one or several files may be selected. File types to be displayed in the browser are:

Information about the file formats is given below.

1.3 Open Group...

Opens a measurement, text or plot file in new measurement group window.

Open Group... does the same as **Insert in Active...**, except:

1. **Open Group…** will open a new window using the settings in the current plot window while **Insert in Active Group…** will insert the data in the active plot.
2. **Plot chart file type (*.tee)** may only be selected from **Open Group...**, because it is a new plot and can not be inserted to a current plot window.

1.3.1 Browser: Open

A browser is displayed. File types to be displayed in the browser are:

The file types are described below

1.3.1.1.1 Measurement Files (*.wmb, *.wmt, *.wav, *.tim)

Lists the measurement file types described below.

1.3.1.1.2 WinMLS Binary Files (*.wmb)

The recommended file type, binary file including header. The header contains information about the sound card and other measurement settings. The header has been extended since WinMLS ver. 2, but the old file format may still be read.

1.3.1.1.3 Measurement Text Files (*.wmt)

File type in text format. It has a header containing some measurement settings. Note that the scaling may not be correct when using this format.

1.3.1.1.4 Mono 16-bit WAV Files (*.wav)

Wave-file, the common binary format for PC audio. If the .wav-file was generated using WinMLS it contains the same header as the ***.wmb**-format is using. Note that the scaling will not be correct when the **.wav**-file is saved in WinMLS using the normalization option. Since the format is 16-bits, it is recommended that it is normalized when saving to obtain the best possible resolution.

1.3.1.1.5 Measurement MLSSA files (*.tim)

File type used by the software MLSSA. Note that the scaling may not be correct when using this format.

1.3.1.1.6 Plot Chart Files (*.tee)

File type containing the chart settings used in the plots. These are the settings found in **Plot->Chart Settings for Active Plot**, e.g. background gradient color, mouse zooming and axis settings.
If such a file type is opened, it is done in a new window.

1.3.1.1.7 TAB-separated Data (*.txt)

Not supported yet in the current version!!! Text-file containing data that is to be plotted. The data must be grouped in columns and separated using TAB. One column of data plots one curve using 0,1,2,3.... as x-axis. Several columns of data will use the first column as x-axis and plots the remaining as curves. All columns must be the same size.

1.4 Close

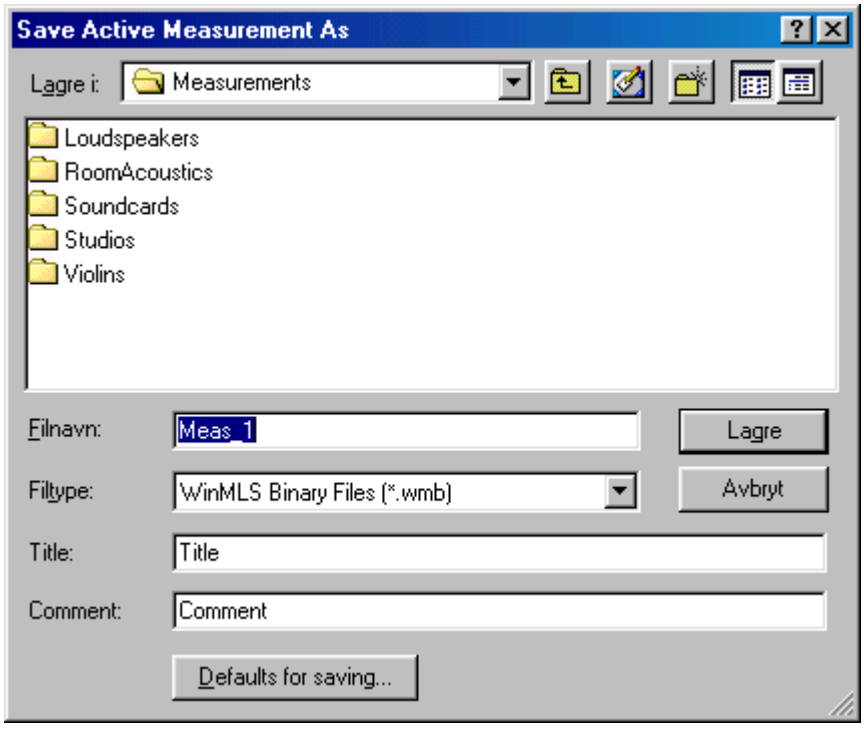
Closes the active window. If there are any unsaved measurements in the window, the user is asked to save or not.

1.5 Save Active Measurement As...

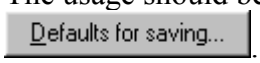
Saves the measurement that is active in the plot window in time domain (e.g. the result of a MLS measurement is an impulse response). The file formats are described in the **Open Group...** chapter above.

If the active measurement is a performed 1-channel measurement or opened from file, the 1-channel browser is displayed. If a 2-channel performed measurement is active, the 2-channel browser is displayed. If a > 2-channel performed measurement is active, the multi-channel browser is displayed. These three browsers are shown below. Note that it is possible to increase the size of the browsers by dragging in the lower left corner.

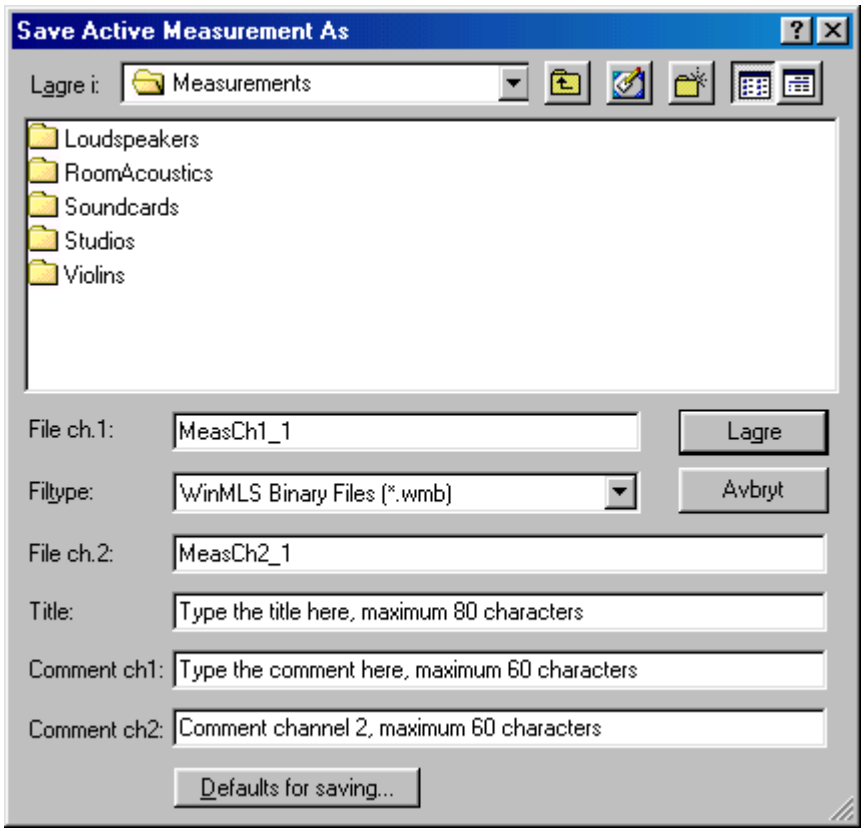
1.5.1 Browser for saving 1-channel measurement

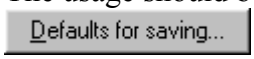


The usage should be quite intuitive. The defaults are set by clicking the button



1.5.2 Browser for saving 2-channel Measurement

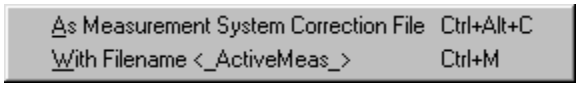


The usage should be quite intuitive. The defaults are set by clicking the button 

which is the same as **Measurement->Defaults for Saving…**.

1.6 Save Active Measurement

Displays sub-menus for saving the active measurement shown below.



Each item is explained below.

1.6.1 As Measurement System Correction File

Saves the active measurement as measurement system correction files and sets it as active in the measurement system correction part of **Measurement->Hardware Calibration...**. It is named **activemeas**. If the active measurement is a multi-channel measurement, each channel will be corrected.

In order to turn on the measurement system correction feature, click the  button on the **Measurement Settings Toolbar**.

1.6.2 With Filename <_ActiveMeas_>

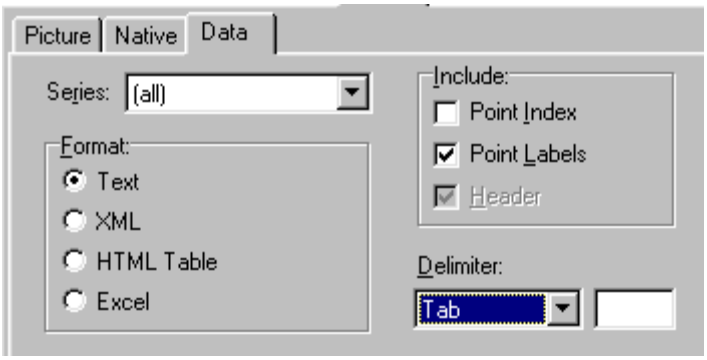
Saves the using the filename '_ActiveMeas_'. The folder and extension is taken from **Measurement->Defaults for Saving...**. Note that if a measurement with the same name already exists, it will be overwritten.
If the active measurement is multi-channel, channel 2 get the name '_ActiveMeas_2', channel 3 gets '_ActiveMeas_3' and so on.
This is the fastest way of saving a measurement and is well suited if another application, e.g. MLSSA, is used to export measurements while measuring with WinMLS.

1.7 Save Data in Active Plot As...

Saves the curves in the plot as columns in a **.txt**-file.
All curves belonging to a measurement in the plot are saved as columns using tab as separator. A one-line header contains the title of the columns. The first column of the header is named ”x-axis”, the next column(s) are given the name of the series title (maximum 30 characters). The character Tab is used as column separators in the header also.

Note that if the x-axis is not the same for all series, then only the curve(s) that has the same x-axis values as the first plotted measurement is saved. This is the case e.g. if the sampling frequency is not the same, e.g. if a value is missing e.g. when plotting room acoustics parameters.

Note also that an alternative method that gives access to advanced settings is found in **Plot->Chart Settings for Active Plot...**, click the **Export** tab, then click the **Data** tab. The dialog box will then show the settings below.



1.8 Save Active Plot As...

Saves the active plot in one of the formats shown below

A method giving access to more advanced settings is found in **Plot->Chart Settings for Active Plot...**, click the **Export** tab. The dialog box will then show the settings below.

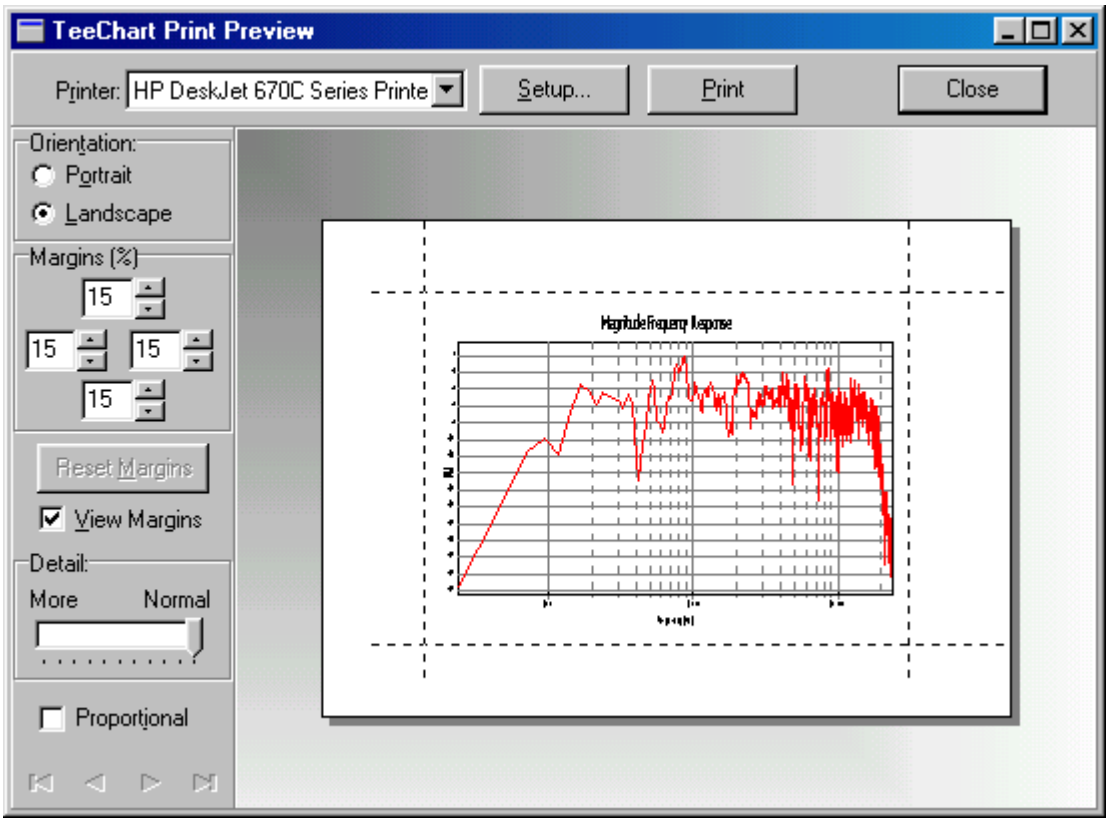
From the example in the figure above, we see that it is possible to set the quality and size when saving as **.jpg**-file.

1.9 Print Active Plot

Prints active plot in active window.

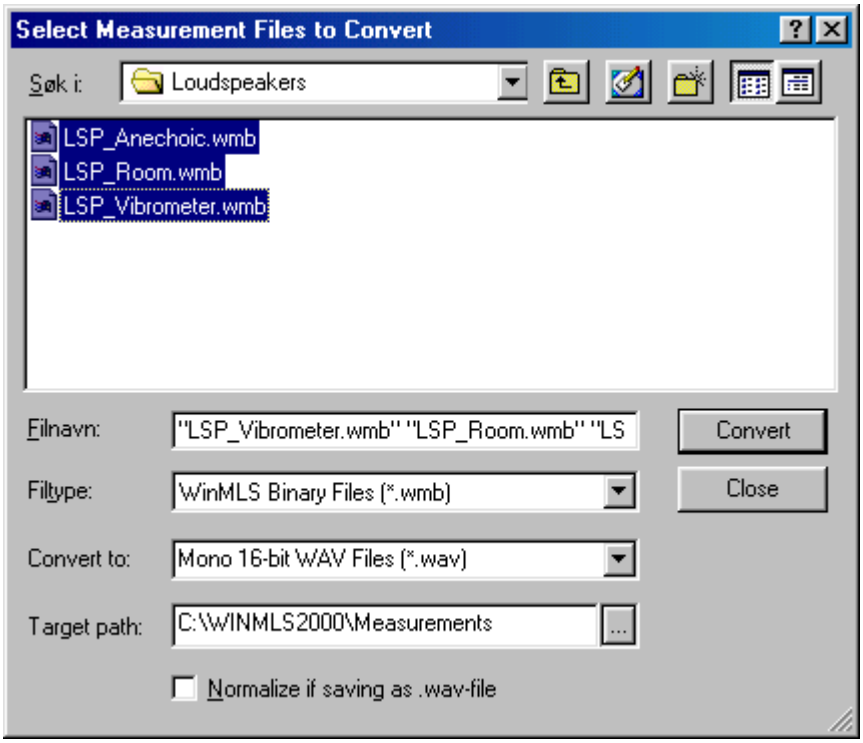
1.10 Print Preview Active Plot...

Print previews active plot in active window.
As we see in the figure below, this dialog box can be used to determine printer, set orientation, margins and amount of details in the plot.



1.11 Convert Measurement(s)...

Converts a measurement file of one of the supported formats to one of the other supported formats.



The dialog box above shows an example on how to convert three files of the format **.wmb** to **.wav**. The **.wav**-files are put under in the **Target path**.

1.12 Exit

Closes all windows and quits WinMLS.

Measurement and post-processing setups are saved to temporary files so the settings are the same the next time WinMLS is opened.

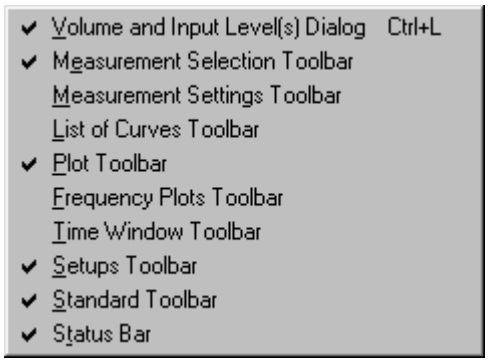
2 Edit

2.1 Copy to clipboard

Copies the active plot to the clipboard so that it may easily be pasted to other software, such as Word.

3 View

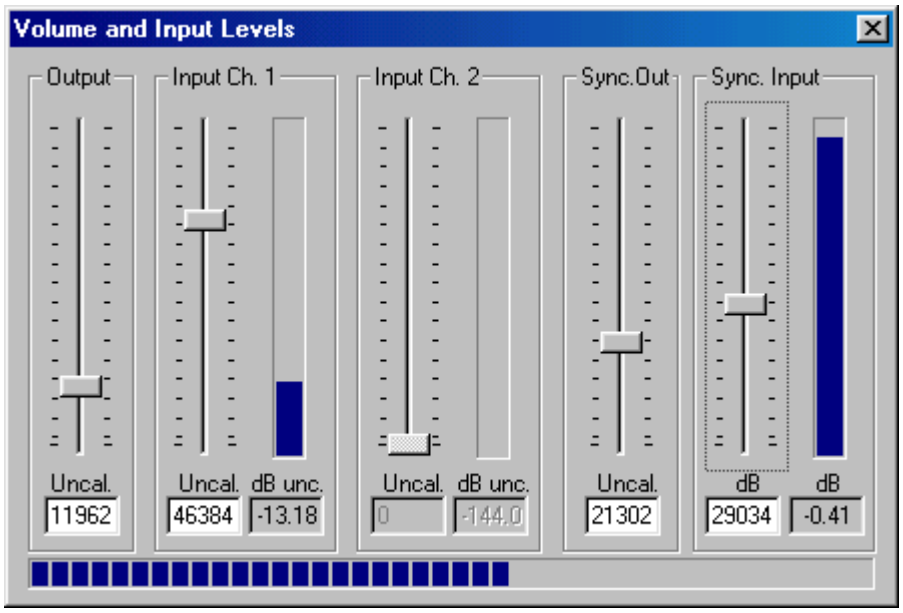
From this menu you can select which resources you wish to view on your screen. The ones which are viewed are check-marked as shown in the figure below.



Note that the toolbars can be moved around and the positions are saved in the post-processing setup file.

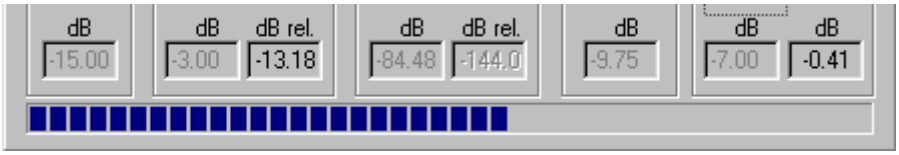
3.1 Volume and Input Level(s) Dialog

Displays a dialog box for setting volume and input level(s).
The content of the dialog box to be displayed depends on the settings. If the WinMLS mixer is used and if measuring in sync. loop-back mode, it will look like the figure below.



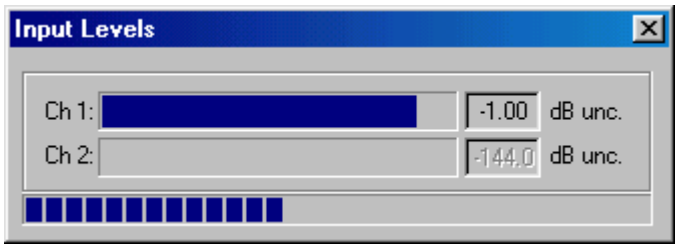
If sync. loop-back mode is not used, the controls **Sync.Out** and **Sync. Input** are not needed and will not be displayed in the dialog box. The horizontal waitbar at the bottom of the dialog box informs the user about the measurement progress.

The sliders are used to set the volumes. If the mixer is not calibrated, **Uncal.** will be written above the volume which may be given a value in the range 0-65535. Changing the volume from e.g. 20000 to 20001 will usually not make any difference. How much it has to be changed to actually change the volume is sound card dependent.
The calibration procedure will determine the volume in dB, and if calibration is turned on (**Measurement->Hardware Calibration**) the last part of the dialog box shown in the figure above will look as shown below.



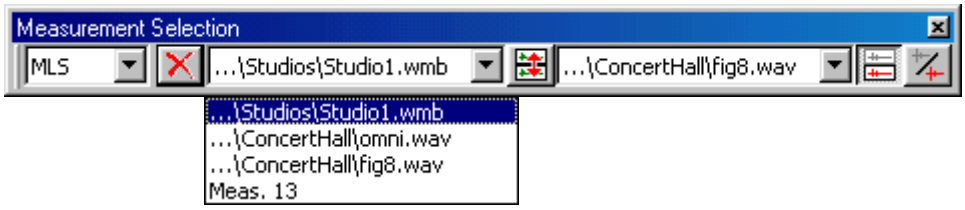
It is now possible to see how much the volume is changed in dB, and this information is used to determine the absolute gain of the systems to be measured.

If the sound card does not support the WinMLS mixer, WinMLS is not able to set the volumes and the dialog shown below will be displayed.



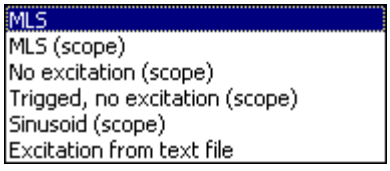
3.2 Measurement Selection Toolbar

The **Measurement Selection Toolbar** is used for selecting measurement mode and measurements for post-processing.



3.2.1  Measurement mode

The measurement modes are shown in the figure below.



3.2.1.1 MLS

This is the default measurement mode and should be used for measurements of impulse/frequency response. The MLS-specific settings are found in the **Measurement Settings Toolbar**.

3.2.1.2 MLS (scope)

This mode is similar to the **MLS** mode, except that no post-processing (Hadamar transform) of the recorded signal is performed. This may be useful for detecting errors.

3.2.1.3 No excitation (scope)

In this mode, no signal is played. It is intended for analyzing a signal, such as finding the background noise level. The length of the recorded signal is also given hereby the **sequence order** in the **Measurement Settings Toolbar**.

3.2.1.4 Trigged, no excitation (scope)

This mode is intended for analyzing impulsive signals. It is similar to the **No excitation (scope)** mode except that the maximum of the signal is automatically detected and the signal shifted so the maximum is found after 150 samples.

3.2.1.5 Sinusoid (scope)

A sinusoid is used for excitation, otherwise the mode is similar to **No excitation (scope)**. **Measurement->Sinusoid Settings** sets the frequency and level of the output signal.

3.2.1.6 Excitation from text file

In this mode, any excitation signal may be specified as a text file. The file must be put in the WinMLS folder and be named **WinMLSExcitation.txt**. An example file is found in the WinMLS folder.

3.2.2  Delete unplotted measurements from memory

Same as **File->Delete unplotted measurements**.

3.2.3  Active measurement in upper plot

From the combo box to the right of the  icon, the active measurement in the plot is selected (if two plots are displayed in the window, it selects the active measurement in the *upper* plot). All the performed and inserted measurements are available from the combo box list.

3.2.4  Update both plots with the same measurement

If the active window contains two plots and if  is toggled, the combo box to the *left* of the button will determine the active measurement for both plots. If it is not toggled, the combo box to

the *right* of the button will determine the active measurement in the lower plot, given that  is toggled (see two chapters below).

3.2.5  Measurement in lower plot or reference measurement

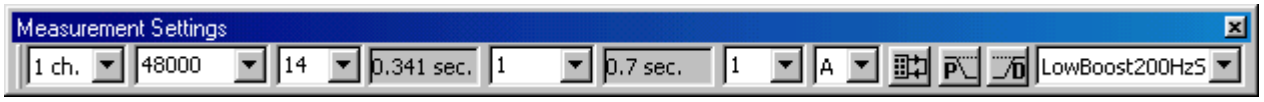
This combo box displays the active measurement in the lower plot if  is toggled. If  is toggled, it displays the reference measurement (the reference measurement is used for division).

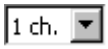
3.2.6  Select "lower plot measurement" or "reference measurement" in combo box

As explained in the chapter above, the status of these two toggles, determines what the combo box to the left of the toggles will display, the active measurement in the lower plot or the reference measurement.

3.3 Measurement Settings Toolbar

As different from the other toolbars, none of the settings in this toolbar can be found in any dialog box. If you intend to use WinMLS for advanced MLS measurements, this toolbar should be useful. It is, however, hidden in the default setup since new users may find it confusing.



3.3.1  Number of Channels to Measure

From this combo box choose the number of channels you want to measure. If this is set to **1 ch.**, one impulse response is the result of a MLS measurement. If it is set to **2 ch.**, two impulse responses will be the result and so on. WinMLS is capable of measuring up to 24 separate channels. In the standard versions 1 or 2 channels are offered, if you need more please contact us.

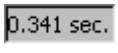
3.3.2  Sampling Frequency

The sampling frequency determines how many samples per second the sound card transmits and receives. It determines the frequency range of your measurements. Theoretically the frequency range is half the sampling frequency (Nyquist criterion). You may get close to this limit if you correct for the influence of the measurement system.
The supported sampling frequencies is sound card-dependent, most sound cards support 11025, 22050 and 44100 Hz. The newer cards support 48000 Hz, and some new cards 96000 Hz. A sound card that supports 192000 Hz should soon be available.
You may select the sampling frequency from the list of the most usual sampling frequencies, but you can also write the number directly in the window. If the sound card does not support the selected sampling rate, an error message will appear when trying to start a measurement.

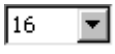
3.3.3  Sequence Order

Range: Typically 11-20 using PC with 16 MB RAM, or even higher order with more RAM.
The important thing to know about the **Sequence Order** is that it determines the number of samples of the measured data. See **Length of Measured Data**, which is discussed below.

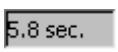
The sequence order determines the number of samples in the maximum length sequence (MLS). The number of samples in the MLS is given as 2^ (Sequence Order) – 1. When the MLS measurement method was first introduced, the maximum length sequence was generated using shift registers. By connecting the shift registers in a special way it was found that a Maximum Length Sequence could be generated. This was the longest sequence that could be made before it repeated itself, and the length was given as 2^(# of shift registers) - 1. The Sequence Order is the same as the number of shift registers used to generate the sequence. It was found that this sequence had very useful properties for measurements.

3.3.4  Length of Measured Data

The **Sequence Order** and the **Sampling Frequency** gives the length of the measured data. Increasing the sequence order increases the length of the measured data, while increasing the sampling frequency decreases it. When measuring systems with long delays, such as a room, this number should be increased. If it is too low, the measured impulse response may have time aliasing. This is because the impulse response has not finished its decay.

3.3.5  Number of Averages

The number of averages determines how many times the MLS signal is repeated during the measurement. The desired number of coherent averages (pre-averages) can be typed in the edit window or chosen from the list. Up to 256 averages can be done if the sound card resolution is 24 bits, and 65536 averages if it is 16 bits.
The reason for averaging is that it will decrease uncorrelated noise and thus increase the quality of the measurements. For doubling of the number of averages, the signal-to-noise ratio is theoretically increased with 3 dB.
The total measurement time increases when the number of averages increases. Note that if the system you are measuring is somewhat time-variant, a long measurement time can decrease the quality of the measurement. An example of a time-variant system is a concert hall where people are running around. Try to avoid measuring during such situations. In any case, for room acoustical measurements, a measurement time of more than 60 seconds is not recommended. Electrical or mechanical systems are usually very little time-invariant, so for those long measurement times seldom is a problem.

3.3.6  Total Meas. Time

The total measurement time is displayed here. It is approximately given as **Length of Measured Data** multiplied by the number of averages plus pre-sent sequences (explained below). If measuring in loop-back mode, add approximately two seconds.

3.3.7 Number of sequences to pre-send

This parameter decides how many times the excitation signal is to be played before the input signal is recorded and the measurement actually takes place.
When measuring using the MLS method, the excitation signal must be played at least once before recording the result. This is because the system to be measured has a transient immediately after the excitation that must be suppressed. After playing one sequence, this should have died out if the other parameters are correctly set. Therefore, the number of sequences to pre-send should be set to 1.

3.3.8 Sequence Type

Two different types of sequences for MLS measurements are available, A or B. This feature is meant for distortion/non-linearity checking. Non-linearity causes spurious peaks in the impulse response. The peaks are replications of the true impulse response. For measurements using a different sequence, these peaks are situated at different places in the impulse response. By visually inspecting two impulse responses measured with different sequences, the amount of non-linearity may be determined. Distortion/non-linearity is usually caused by the transducers (either microphone or loudspeaker) and may in some cases be reduced by reducing the volume.

3.3.9 Measurement System Correction

Using this option will correct your measurements for the influence of the measurement system. But in order to do this, your measurement system first has to be measured. The procedure for this is described in the FAQ. Measurement System Correction is not recommended if you measure *without* using synchronization loop-back because a linear phase shift is added since the start of the impulse response may not be correctly determined. Also the magnitude frequency response may in some cases be incorrect because of this shift of the impulse response.

If you measure using synchronization loop-back, you might experience a small tail at the very end of the impulse response. This is a result of the correction filtering procedure. If this tail is more than –50 dB below the maximum of the impulse response, it should be nothing to worry about for most applications.

When the Measurement System Correction is turned on, the relative amplification will be measured, even if no level calibration has been performed. If the amplification of the system you are measuring has increased 5 dB after you performed the reference measurement, the peak of the impulse response will be at 5 dB. The linear amplification may be displayed by plotting for example the first part (it is given by the maximum) of the impulse response using linear axis. To plot the amplification in dB, do the same using logarithmic x-axis, or plot the magnitude frequency response.

3.3.10 Pre-emphasis

This option will pre-filter the excitation signal using the filter found in the **Type of Emphasis** combo box described below.

3.3.11 De-emphasis

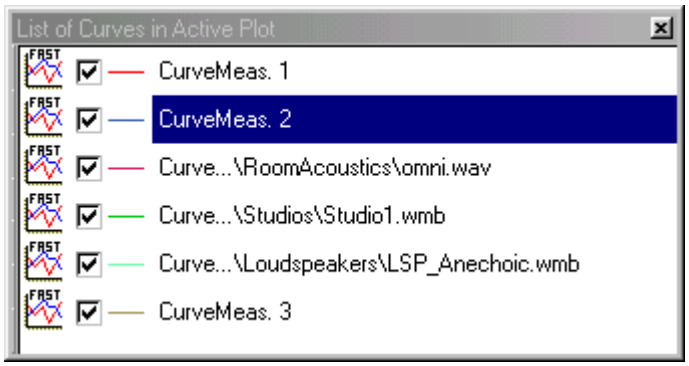
This option will post-filter the recorded signal using the inverted filter found in the **Type of Emphasis** combo box described below.

3.3.12 LowBoost200HzS Type of emphasis

This combo box contains the filter(s) used for pre- and de-emphasis. The MLS signal is initially white, which means that it contains an equal amount of all frequencies. For most acoustics measurements it gives a better result to use a signal that gives more power to the lower frequencies. Selecting **LowBoost200HzShelvingFirstOrder** it will boost the frequencies below 200 Hz with 20 dB using a first order filter. For more information read *How to add pre-filtering (emphasis) to the excitation signal (MLS)?* in the FAQ.

3.4 List of Curves Toolbar

This toolbar gives immediate access to the curves in the active plot.



The operations described below can be done from this toolbar. Note that if two plots are displayed in the window, the operations will only affect the active plot.

3.4.1 Deleting curve(s) from the plot

A curve may be deleted by first marking it, then pushing the **Delete** key. In the figure above, the curve named **CurveMeas. 2** is marked since it has a blue background. Note that if several curves are marked, they may all be deleted.

3.4.2 Dragging curves to change the order

If a curve in the toolbar is marked (**CurveMeas. 2** in the example above), the curve may be dragged up or down using the mouse. Note that the curve at the *end* of the list is displayed as the *top* curve in the plot. In the figure above, **CurveMeas. 3** will be displayed on top, while **CurveMeas. 1** will be below all the other curves.
Note that if several curves are marked, they may all be dragged.

3.4.3 Change curve type

Clicking on this icon, will display a dialog box where a new curve type may be selected.

3.4.4 ☑ Display the curve

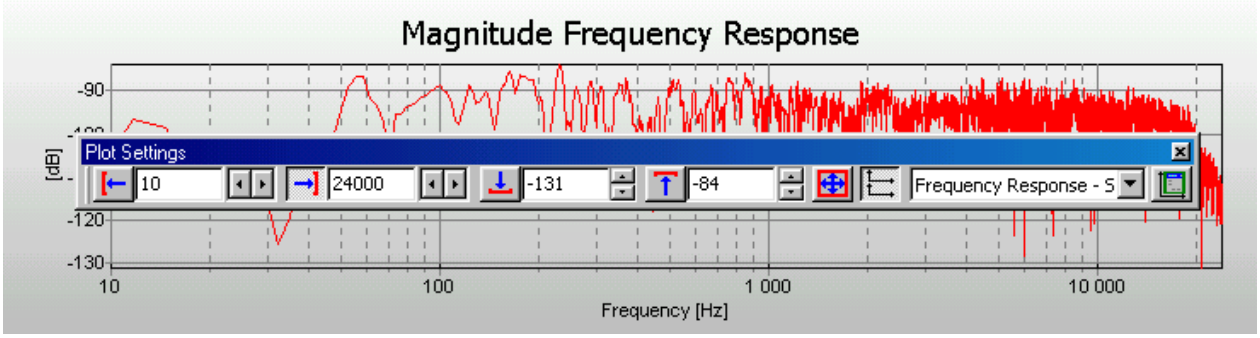
If ☑ is checked, the curve will be displayed in the plot. If not it will not be displayed but is present in memory and may be displayed later.

3.4.5 — Change the curve color

The color of a curve may be changed by clicking — (found to the left of **Curve Meas. 1** in the figure of the toolbar above). A dialog box will be displayed from where a new color may be selected.

3.5 Plot Toolbar

This toolbar should be found very useful. It contains settings for zooming in x- and y-direction, selecting one or two plots, which plot type(s) to be displayed and finally a button for accessing the settings of the active plot type. In the figure below we see a plot with the toolbar on top.



Note that if two plots are plotted in the current window, the settings for the active plot will be displayed in the toolbar. It is a good exercise to click in the other plot to set it active and see how the toolbar settings will change.

3.5.1 [←] 10 [◂][▸] Setting the lower x-axis limit

The controls shown above are used to set the lower x-axis limit.

If *auto-scale lower x-limit* [←] is toggled, the minimum x-value of any of the curves in the plot will be used as minimum value. The edit window 10 shows the current value, 10 Hz in this example. It is possible to type a new value, but remember to validate it by clicking **Enter**.

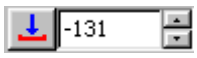
The controls [◂][▸] are used for moving the limit in either left or right direction.

3.5.2 [→] 24000 [◂][▸] Setting the upper x-axis limit

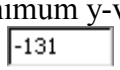
The controls shown above are used to set the upper x-axis limit.

If *auto-scale upper x-limit* [→] is toggled, the maximum x-value of any of the curves in the plot will be used as maximum value. The edit window 24000 shows the current value, 24000 Hz in this example, which is the maximum in x-direction since [→] is toggled. It is possible to type a new value, but remember to validate it by clicking **Enter**.

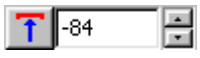
The controls  are used for moving the limit in either left or right direction.

3.5.3  Setting the lower y-axis limit

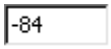
The controls shown above are used to set the lower y-axis limit.

If *auto-scale lower y-limit*  is toggled, the minimum y-value of any of the curves in the plot will be used as minimum value. The edit window  shows the current value. It is possible to type a new value, but remember to validate it by clicking **Enter**.

The controls  are used for moving the limit either up or down.

3.5.4  Setting the upper y-axis limit

The controls shown above are used to set the upper y-axis limit.

If *auto-scale upper y-limit*  is toggled, the maximum x-value of any of the curves in the plot will be used as maximum value. The edit window  shows the current value. It is possible to type a new value, but remember to validate it by clicking **Enter**.

The controls  are used for moving the limit either up or down.

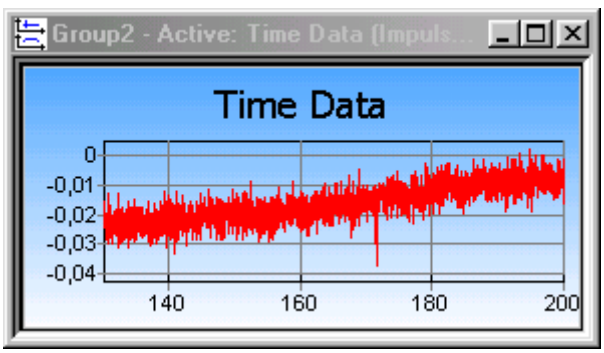
3.5.5  Auto-scale the plot in all directions

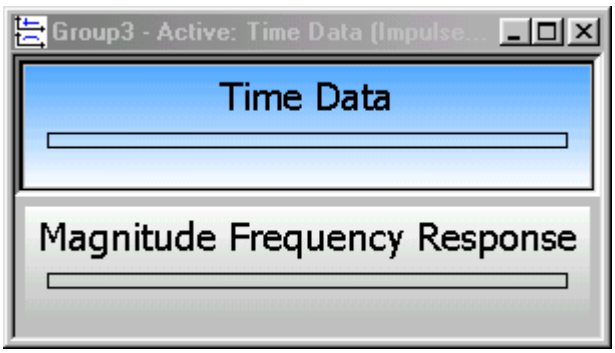
This is a very method of auto-scaling a plot.

If  is toggled, the plot is auto-scaled in all x- and y-direction. As a result of this, all the four buttons  ,  ,  and  will be toggled. So clicking  has the same effect as clicking all these four buttons.

3.5.6  Display one or two plots in the window

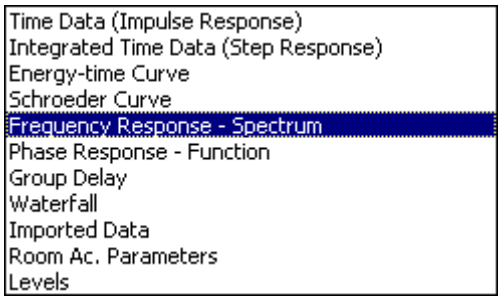
If  is not togged, one plot is displayed in the active window as shown in the left part of the figure below. If  is toggled, two plots are displayed in the active window as shown in the right part of the figure below.





3.5.7 Frequency Response - S Selecting Plot Type in Active Plot

This combo box contains the plots shown in the figure below and lets the user select which plot type the active plot should contain.



3.5.8 Settings for the Active Plot

Clicking on this button will display a dialog box containing the settings for the active plot. An alternative method is to double click in the active plot.

3.6 Frequency Plots Toolbar

This toolbar gives quick access to settings useful for all the general frequency domain plot types (magnitude, phase, group delay and waterfall).

Note that if two plots are displayed in a window, the toggles will affect only the active plot. An exception is the toggles involving the "global" **Plot->General Frequency Domain Settings…**.

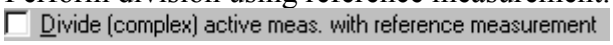
Log x Logarithmic x-axis. Same as X-Axis: Hz - Logarithmic found in the plot type settings. In case WinMLS is displaying two plots, only the active plot will be refreshed when the button is clicked.

Smooth curve. Same as Use Smoothing found in the plot type settings. In case WinMLS is displaying two plots, only the active plot will be refreshed when the button is clicked.

INV Invert curve. Same as Invert resulting response (complex) in **Plot->General Frequency Domain Settings…**

Microphone compensation. Same as Microphone: found in settings for the *Frequency Response/Spectrum* plot type

Display guidelines on frequency response. Same as Add Guidelines found only in settings for *Frequency Response/Spectrum* plot type

Perform division using reference measurement. Same as 

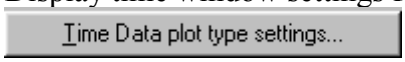
in **Plot->General Frequency Domain Settings…**

Update reference measurement on new measurement. Same as 

in **Plot->General Frequency Domain Settings…**

Display time window settings for the reference measurement. Same as 

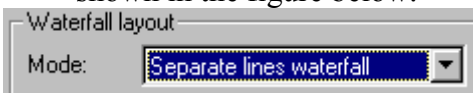
in **Reference measurement** group in **Plot->General Frequency Domain Settings…**

Display time window settings for the active measurement. Same as 

in **Active measurement** group in **Plot->General Frequency Domain Settings…**

File->General Frequency Domain Settings…

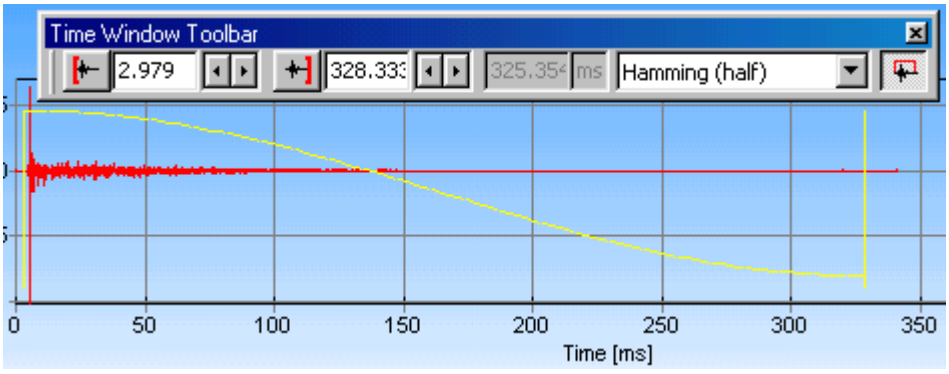
Waterfall slice scrolling downwards, used to set the active slice, for reading cursor values displayed at the **Status Bar**. The active slice gets a green color. This button is enabled only if the waterfall layout mode in the waterfall plot type settings is **Separate lines waterfall** as shown in the figure below.

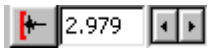


Waterfall slice scrolling upwards, used to set the active slice, for reading cursor values displayed at the **Status Bar**. The active slice gets a green color. This button is enabled only if the waterfall layout mode in the waterfall plot type settings is **Separate lines waterfall** as shown in the figure above.

3.7 Time Window Toolbar

This toolbar will set the time window used for FFT-calculation for the frequency domain plot types. Below the toolbar is displayed together with the **Time Data** plot type. The time data window is displayed in yellow.



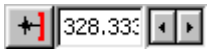
3.7.1  Setting the lower window limit

The controls shown above are used to set the lower window limit.

The button  will move the time window to the lowest possible value.

The edit window  shows the current value in the unit displayed in  as will be explained below. It is possible to type a new value, but remember to validate it by clicking **Enter**.

The controls  will move the window one sample in each direction and is thus to be used only if very small moves are required.

3.7.2  Setting the upper window limit

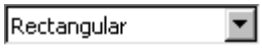
The controls shown above are used to set the upper window limit. They work similar to those described in the chapter above, so no further explanation should be needed.

3.7.3  Window length

This control shows the total window length in the unit displayed in  as will be explained below.

3.7.4  Window x-axis unit

This control displays the unit of the x-axis. In the figure above it is set to **ms**, which means that the unit is milliseconds. The unit is always the same as the x-axis unit for the **Time Data** plot type.

3.7.5  Time data window type

The possible window types are shown below.

Note that when windowing transient signals such as impulse responses, a *rectangular* or *half* window should be used. A full window is usually used for stationary signals.

3.7.6  Display time window in time data plot type

If this is toggled, the selected time window will be displayed when plotting **Time data**.

3.8 Setups Toolbar

Using this toolbar is a convenient way of loading and saving the measurement and post-processing setups.

The purpose of this dialog bar is to make it easier for the user who wants to work with setup files. All the WinMLS settings are saved in setup files. From this toolbar most things can be done, except deleting a setup file which can be done from **Measurement->Save/Load Measurement Setup…** or **Plot->Save/Load Post-proc Setup…**.

The save diskette-icon would change appearance when the setup is changed, e.g. it is disabled when it is not changed. This is the way for the user to see if the settings have been changed, this I think will be useful!!!

3.8.1  Select a new Measurement Setup

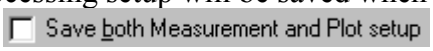
From this combo box a new measurement setup may be loaded. In addition to the measurement settings, post-processing settings will also be loaded, since the measurement setup contains a link to the post-processing setup. This measurement setup combo box thus is able to load all WinMLS settings.

3.8.2  Save Measurement Setup

Click this button to save the measurement setup, the **Save As** dialog box will be displayed, this will be described under **Measurement->Save/Load Measurement Setup…**.

If any of the measurement settings are changed, the icon turns red  . This way the user will be notified that the settings have been changed since the last setup was loaded.

3.8.3  Save Post-processing Setup when Measurement Setup is saved

If this is toggled, the post-processing setup will be saved when the measurement setup is saved. The toggle is the same as the  setting in **Plot->Save/Load Post-proc Setup…**.

3.8.4  Select a new Post-processing Setup

From this combo box a new post-processing setup may be loaded.

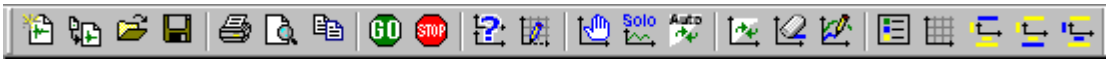
3.8.5  Save Measurement Setup

Click this button to save the post-processing setup, the **Save As** dialog box will be displayed. This will be described under **Measurement->Save/Load Measurement Setup…**.

If any of the post-processing settings are changed, the icon turns red  . This way the user will be notified that the settings have been changed since the last setup was loaded.

3.9 Standard Toolbar

The standard toolbar contains the most frequently used buttons.



File->New…

File->Insert…

File->Open…

File->Save Active Measurement As…

File->Print

File->Print Preview…

Edit->Copy to Clipboard

Measurement->Start Measurement

Measurement->Cancel Measurement

Plot->Select Plot Type(s) and Active Meas…

Plot->Chart Settings for Active Plot...

Plot->Hold Plotted Curves

Plot->Solo Active Measurement Curve

Plot->Auto Refresh

Determines if auto refresh is turned on or off. If it is turned on, it can be in two modes as seen from the **Plot->Auto Refresh** sub-menu. Either **Active Measurement** or **All Measurements**.

Plot->Refresh All

Plot->Delete All Curves

Plot->Add Curve(s)

Add *legend* to active plot. This and other *legend* settings are found in **Plot->Chart Settings for Active Plot...**, select the **Legend** tab.

Add *gridlines* to active plot. This and other *gridlines* settings are found in **Plot->Chart Settings for Active Plot...**, select the **Axis** tab, then select the **Ticks** tab, or the **Minor** tab for the minor gridlines.

Display *title* to active plot. This and other *title* settings are found in **Plot->Chart Settings for Active Plot...**, select the **Titles** tab.

Display *footer* to active plot. This and other *comment* settings are found in **Plot->Chart Settings for Active Plot...**, select the **Titles** tab. Then select **SubFoot** as shown in the figure below.

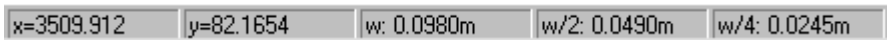
Display *axis title* to active plot. This and other *axis title* settings are found in **Plot->Chart Settings for Active Plot...**, select the **Title** tab.

3.10 Status Bar

The status bar is displayed at the bottom line of the software. The left part is used to display the help text when the mouse cursor is placed at a control. For example, if the mouse cursor is placed at the  button, the text Print Preview active plot will be displayed.

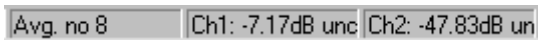
To the right of the help text, the cursor values (x,y) in the plot is displayed, as shown above. This is the position of the mouse pointer relative to the curve of the active measurement. Using this you can read out the values of the active measurement curve. Note that if you have plotted several measurements it is the cursor values of the active measurement that will be displayed.

If a frequency domain plot type is displayed, the wavelength, half- and quarter-wavelength will be displayed to the right of the cursor values as shown in the figure below.



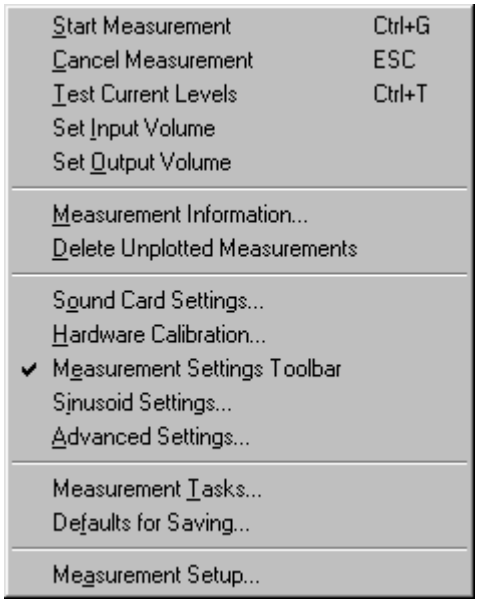
3.10.1 Status bar during a measurement

When performing a measurement, the current average and its input level(s) are displayed in the status bar. In the figure below the levels for average 8 for a 2 channel measurement is displayed.



4 Measurement

This menu contains the measurement settings



4.1 Start Measurement

Starts a measurement using the current settings.
A too high output volume may damage your equipment, so consider adjusting down the output volume before selecting this option. The levels cannot be adjusted during a MLS measurement since it will give a wrong result.

4.2 Cancel Measurement

Cancels a measurement if one is being performed.

4.3 Test Current Levels

Recording (and playback) is started so the user may see the current input (and output) level(s). This is useful for setting optimal levels before performing a measurement.
Note that a too high output volume may damage your equipment, so consider turning down the output volume before selecting this option.

4.4 Set Input Volume(s)

Sets the input volume, starting from the lowest possible level and gradually increasing. The volume is adjusted so the input level is set in the range –1.5 dB to –5 dB. These limits may be set in **Measurement->Advanced Settings…**.

The procedure works only if the WinMLS mixer is supported, and it works for 1- and 2-channel measurements.

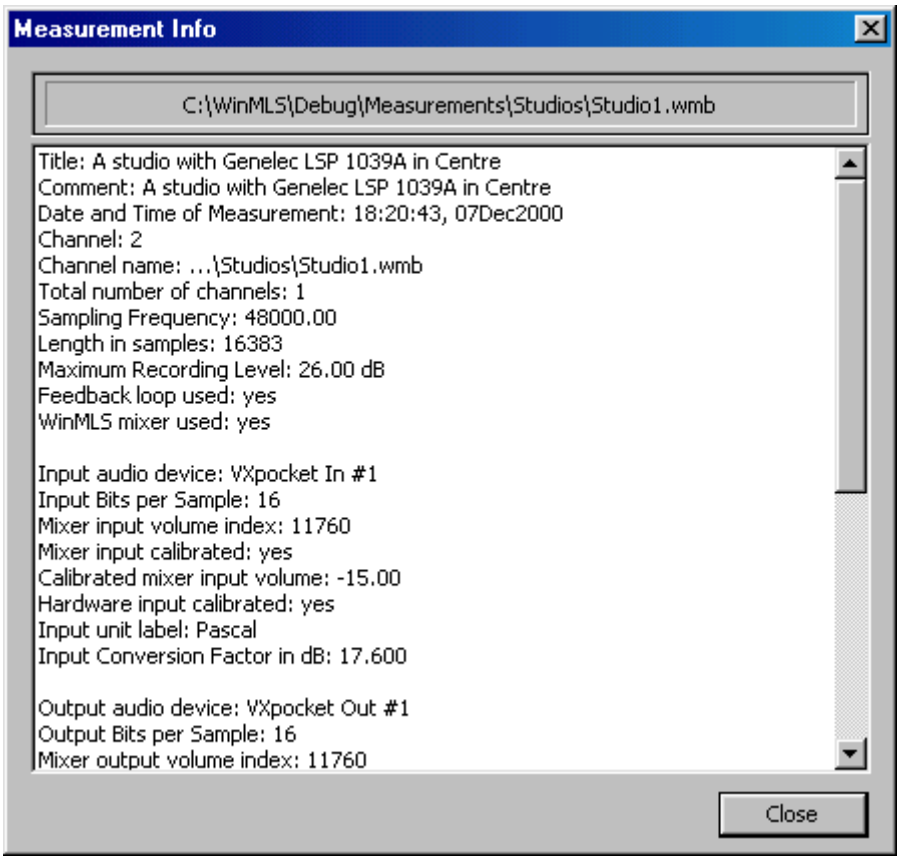
If the procedure is slow, adjusting the volume sliders manually will help increasing the speed.

4.5 Set Output Volume

Sets the output volume. This procedure is similar to setting the input volume as discussed above.

4.6 Measurement Information…

Displays information on the *active* measurement as shown in the figure below.



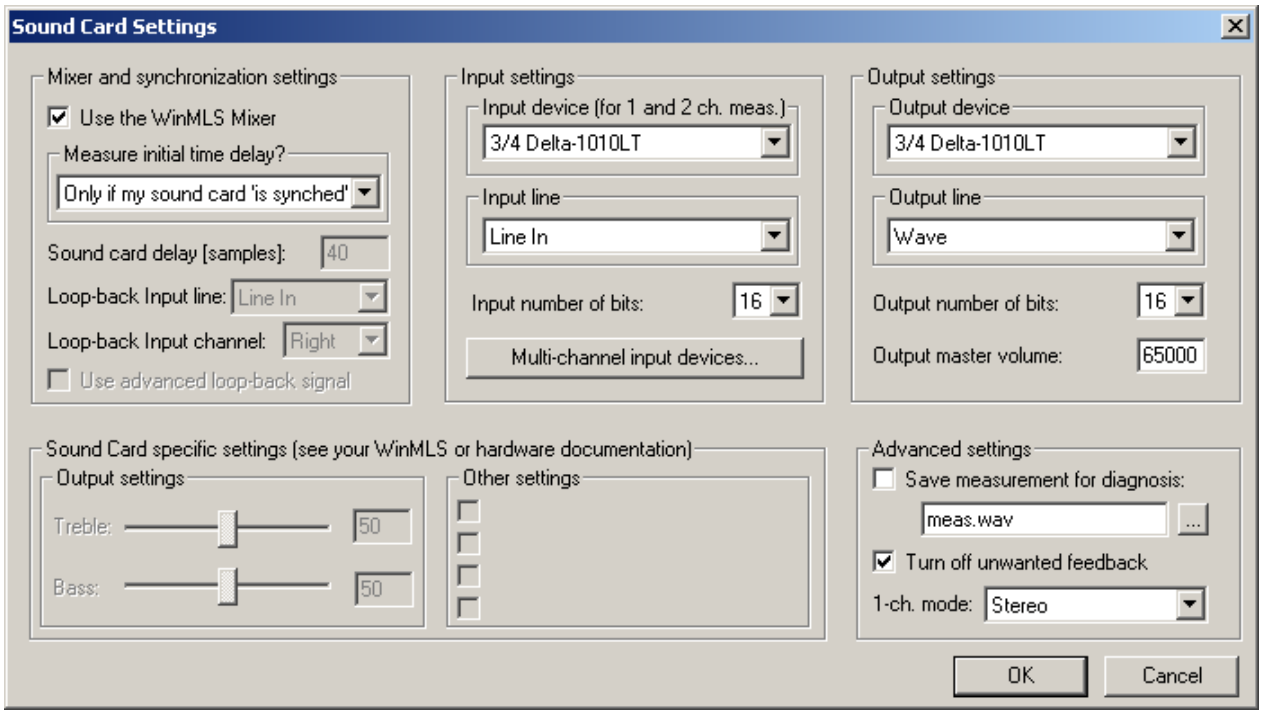
Note that the measurement file formats **.wmb** and **.wav** will contain all information, while the formats **.wmt** and **.tim** contain less information. However, note that if the **.wav**-file is normalized when saved, its level information will not be correct.

4.7 Delete Unplotted Measurements

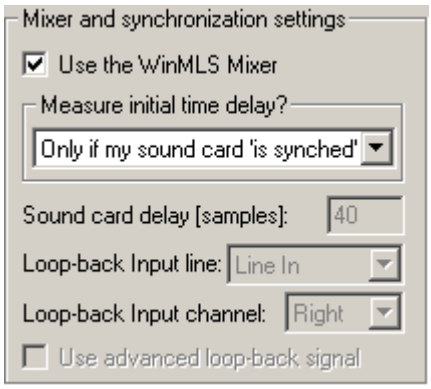
Deletes all the measurements that are present in the memory (of the active window), except the measurements that are plotted.
Even the unsaved measurements will be deleted. Since WinMLS stores all the performed and inserted measurements in memory as default, it may be needed to clear the memory.

4.8 Sound Card Settings

Opens the Sound Card Settings dialog as shown below.



4.8.1 Mixer and Synchronization Settings

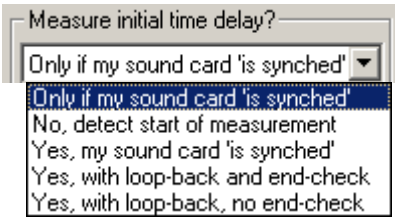


Use the WinMLS Mixer should be checked to make use of the WinMLS internal mixer. If it cannot be checked, this may be because your sound card does not have a software mixer, or it is not compatible with the Windows® sound system. If not checked, several settings in this dialog box will be disabled.

4.8.1.1 Synchronization Mode – Measurement of initial time delay, or not.

Use loop-back for synchronization should be checked if the measurement is to be performed in loop-back mode. Then the settings below must be set.

The initial time delay is the same as the time a pulse takes to travel through the system we are measuring. Typically the distance from the loudspeaker to the microphone. This can be measured in several ways when measuring transfer functions with WinMLS.
These settings only apply when measuring transfer functions and *not* when measuring in scope mode.



Each of the items in the list shown in the figure above is explained in the chapters below.

4.8.1.1.1 Only if my sound card 'is synched'

'*Is synched'* means that the sound card is able to start record and playback at the same time, or with a delay that is constant. This must be fulfilled to be able to measure the initial time delay correctly.

Note that the constant time delay for the sound cards may be of importance. If this is the case, use the mode **Yes, my sound card 'is synched'** explained below.

WinMLS checks the sound card type. If it is one of the types we have tested and found to be *'synched'* then the measurement is performed so that the initial time delay will be found.

In the current version of WinMLS the Digigram VX sound cards, Siena, Card Deluxe and Delta 1010LT is on the "list". Please note that the Digigram VX pocket and Delta 1010LT has a deviation of 1 sample when using this method of determining initial time delay.

If the sound card is not found in our list, then the measurement is performed in the **No, detect start of measurement** mode explained below.

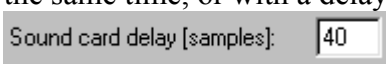
4.8.1.1.2 No, detect start of measurement

This mode does not measure the initial time delay. The initial time delay is removed so the impulse starts from the very beginning. A special algorithm is used to detect the start of the impulse response.

Multi-channel measurement note: The start detection will not work properly if a multi-channel transfer function measurement is performed and one of the channels contains a non-impulsive signal. This is because all channels are searched to find the start of the first pulse.

4.8.1.1.3 Yes, my sound card 'is synched'

You can select this mode if you know that your sound card is able to start record and playback at the same time, or with a delay that is constant. The constant delay can be corrected for in the



setting explained below.

The initial time delay will be measured if this is set properly.

4.8.1.1.4 Yes, with loop-back and end-check

The measurement is performed using a physical loop-back, usually connected from output right channel to input right channel.
A pulse is sent through the loop-back before the measurement is performed and it makes it possible to determine the initial time delay correctly.
After the measurement is finished, a pulse is also sent through the loop-back. The time delay between this pulse and the pulse sent before the measurement was started is checked. This *end-check* is used to detect errors in the measurement caused by non-continuous play or record. The loop-back settings (see below) must be properly set.

For more detailed explanation see the **WinMLS User's Guide** in the chapter **Measurement 3: Measuring using loop-back.**

4.8.1.1.5 Yes, with loop-back, no end-check

Same as the mode above, except that the end-check is not performed. This means that this mode measures the initial time delay exact, but errors in the measurement caused by non-continuous play or record are not detected. The loop-back settings (see below) must be properly set.

gives the delay of the sound card in samples. This is found by doing a MLS measurement of the sound card with its input connected to the output using a cable. Plotting the first part of the resulting impulse response using Time Data as plot-type and Samples as x-axis, will show the delay.

4.8.1.2 Loop-back settings

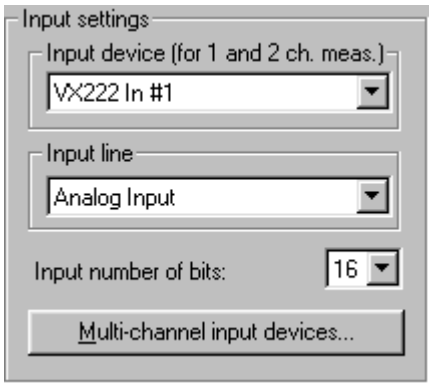
gives the delay of the sound card in samples. The delay is found by doing a MLS measurement of the sound card with its input connected to the output using a cable. Plotting the first part of the resulting impulse response using Time Data as plot-type and Samples as x-axis, will show the delay. In addition to being used for the loop-back, this setting is also used for the **Yes, my sound card 'is synched'** mode.

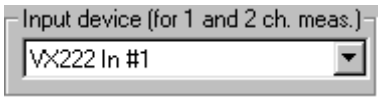
gives the input line used when performing a loop-back measurement. For the Digigram® cards, **Analog Input** should be selected, but for other sound cards it is usually **Mic** or **Line**.

gives the channel that the loop-back is to be connected to. If the loop-back input is stereo, it is usually connected to **Right** channel. But if it is mono (e.g. the **Mic** input), it must be set to **Left**.

should be checked if problems occur when measuring in loop-back mode. A short MLS signal is used for the synchronization instead of the standard pulse. This signal is less prone to noise, but may demands a fast PC since will need more processing. If you are using a sound card capable of measuring DC offset (e.g. TB Tahiti/Monterey) it is strongly recommended to use this setting.

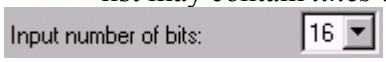
4.8.2 Input Settings



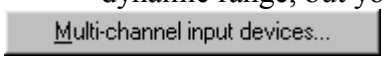


gives the sound card input device. Note that the combo box list may contain devices that cannot be used for measurements.

gives the input line. For the Digigram® cards, **Analog Input** should be selected, but for other sound cards it is usually **Line**, or **Mic**. Note that the combo box list may contain *lines* that cannot be used for measurements, e.g. **CD player** and **Aux**.

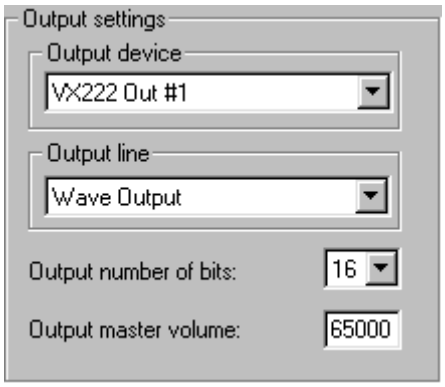


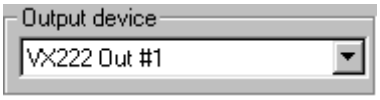
gives the bit depth used for recording. You may choose either 16 or 24 bits. 24 bits usually gives a slightly better measurement result and allows a larger dynamic range, but your sound card may not support 24 bits.



opens the dialog box for setting input devices if a multi-channel (>2 channels) measurement is to be performed.

4.8.3 Output Settings





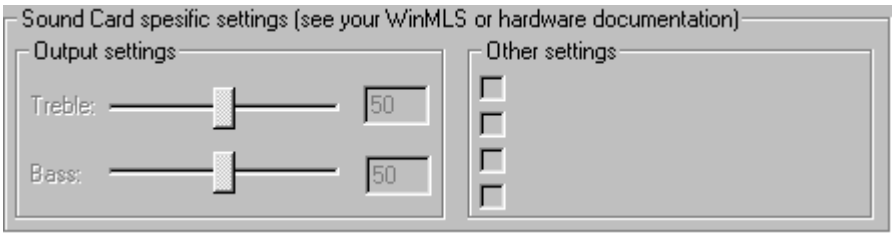
gives the sound card output device. Note that the combo box list may contain devices that cannot be used for measurements.

gives the input line. It is usually called **Wave Output** or **Wave**, or a translation if your operative system is not English.

gives the bit depth used for playback. You may choose either 16 or 24 bits. Your sound card may only support 16 bits. Bit depth makes no difference to the MLS signal if emphasis is not used, but 24 bits usually gives slightly better measurement results if pre-emphasis is used.

gives the master volume for all output lines and can be given a value from 0 to 65535. We recommend that you set it to 65000 (or exactly the maximum value 65535). If you have problems with distortion on your sound card output, then setting a lower value might reduce this.

4.8.4 Sound Card Specific Settings

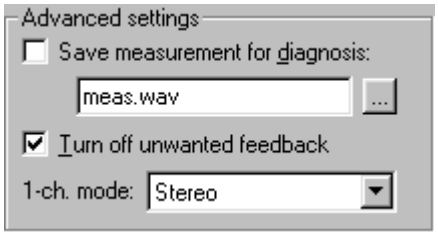


The sound card specific settings are sound card dependent. On some sound cards you may set Treble and Bass, 3-D sound and other settings, but for other sound cards no such settings are supported. In that case all settings will be ghosted as shown in the figure above.
If your sound card has such special settings, it is likely that they will influence the result of your MLS measurements. Therefore, WinMLS will extract these settings and allow you to set them. These settings will be saved in the measurement setup file as the other measurement settings. This way you are sure to have exactly the same settings each time you do a measurement.

The output tone controls **Treble** and **Bass** found on the left side of the figure above can be set to a number from 0 to 100. This setting will greatly affect the frequency response of your sound card. You may use this as an equalizer to boost either the high or the low frequency region.
If any of the **Other settings** are supported, they will be listed and turned off as default. You may turn them on by checking them. We recommend that you do not check the controls unless you know exactly what the control does. For more information about this, consult your sound card hardware documentation. A way of testing it would be to compare a measurement with the control turned off with a measurement with the control turned on.

Note that it is possible that a sound card has settings that is not displayed in the **Sound card specific settings**, e.g. the Digigram sound cards volume settings **Advanced Input** and **Advanced Output**.

4.8.5 Advanced settings



should be checked if you want to save everything that is recorded during the whole measurement to a **.wav** file. This can be useful if you need to see what has happened during your measurement. Then you can simply play the file and listen to it, or open the file in a sound editor. For 1 channel measurements, a mono **.wav** file is generated, for multi-channel measurements a stereo **.wav** file is generated.

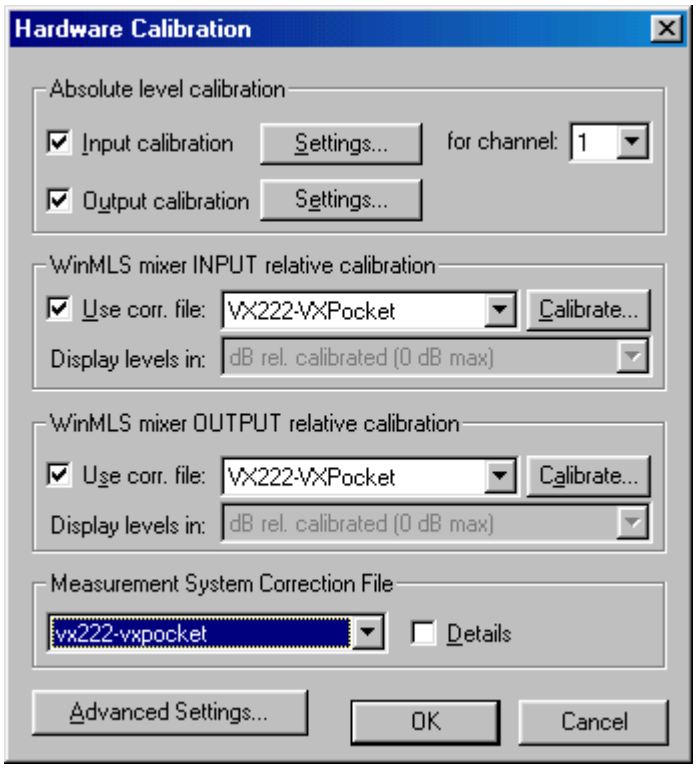
gives the name and path of the diagnosis file to be saved.

determines if unwanted feedback that may occur between the measurements should be turned off. If this is not checked, feedback may occur between the measurements because then the original sound card volume is being restored. If checked, it will make sure that the volume setting causing feedback is turned off.

gives if input/output is mono or stereo when performing a 1-channel measurement. In most cases this should be set to **Stereo**. However, if you have a sound card that is mono full duplex (probably an older card), you may set it to **Mono**.

4.9 Hardware Calibration…

Displays the dialog box shown below.

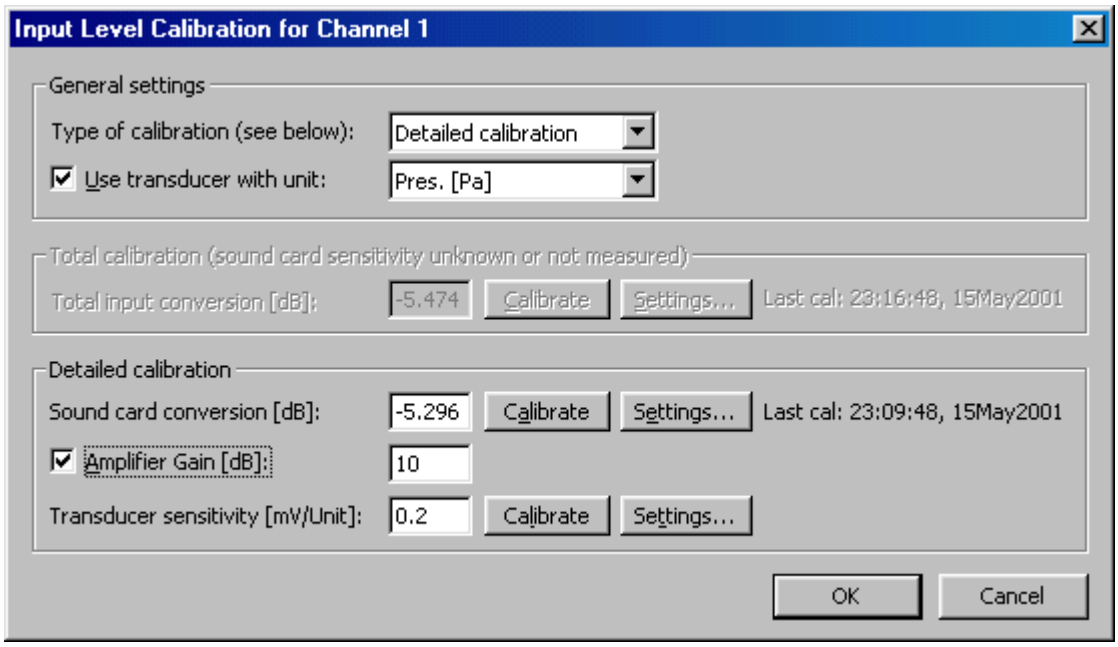


4.9.1 Absolute Input Level Calibration

Input calibration determines if the input is to be absolute calibrated.

Settings... displays the input absolute calibration settings dialog box as described below.

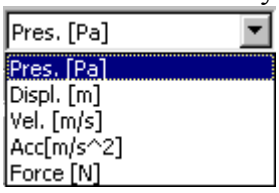
for channel: 1 determines which channel the **Settings…** are displayed for. For a 1-channel measurement, this number should be set to 1.



4.9.1.1 General settings

Detailed calibration is used to choose between **Detailed calibration** and **Total calibration**. These will be discussed below.

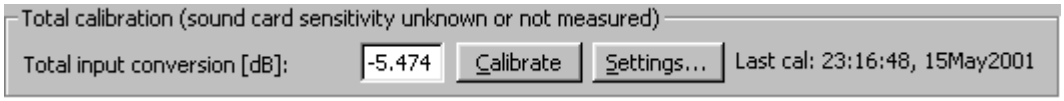
Use transducer with unit: should be checked if you are having a transducer (e.g. a microphone) connected to the input. It makes sure the units are correctly set and allows you to specify the transducer sensitivity if **Detailed calibration** is selected.



choose the unit of your transducer. If you are using a microphone, select **Pres [Pa]**.

4.9.1.2 Total calibration

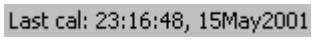
The purpose of this type of calibration is to calibrate the whole input chain in one operation without having to calibrate the sound card first. This calibration is fast and simple, but we recommend that you instead use the **Detailed Calibration** (see below) if you are using WinMLS both for electrical measurements and measurements where you are using a transducer (e.g. a microphone), or a pre-amplifier with changeable gain.



-5.474 gives the number WinMLS uses to calibrate the input. This number will automatically be set when clicking the Calibrate button, but it may be manually set.

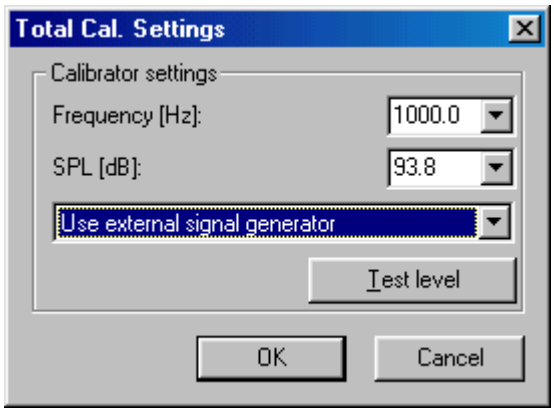
Calibrate performs the calibration procedure.

opens the calibration settings shown below.



displays the date of the last calibration. It is set by clicking 

.

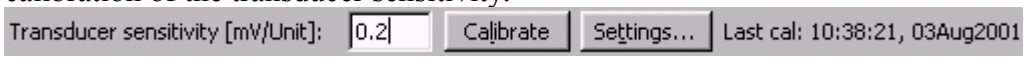


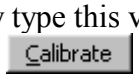
In the dialog box above you can set the level and frequency for the calibration, and choose if you want to use an external signal generator or use the sound card output as signal generator. Using the sound card output should be fine as long as you have something to measure the signal level with (the measured level is used as the reference level), e.g. a voltage meter if you are doing an electrical calibration. The **Test level** button should be clicked to test the levels.

4.9.1.3 Detailed Calibration

is for calibrating the sound card input sensitivity. This must be done before calibrating the **Transducer sensitivity**.

should be turned on if you are using an external pre-amplifier. Type the amplifier gain in the edit box. If you want to determine the amplification of the pre-amplifier, we suggest that you do this manually by plotting the frequency response of the measurement system with and without the pre-amplifier. Note that the sound card calibration and the pre-amplifier gain and status (checked/unchecked) must be correct in order to get a correct calibration of the transducer sensitivity.



the transducer sensitivity of your transducer may be given by the manufacturer, then you may type this value in the edit box. You may also measured the transducer sensitivity by clicking the 

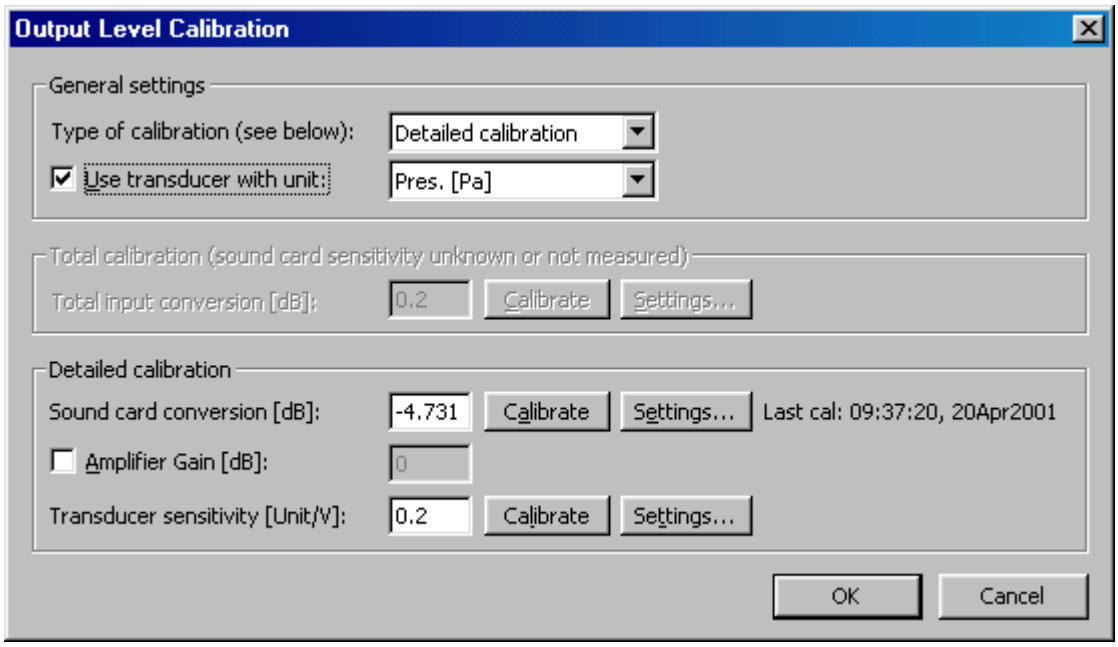
button.

However, you should first click the Settings... button to set the correct calibration settings. You must also make sure the **Amplifier Gain** and **Sound card conversion** settings are correct.

4.9.2 Absolute output level calibration

Output calibration Determines if the input is to be absolute calibrated.

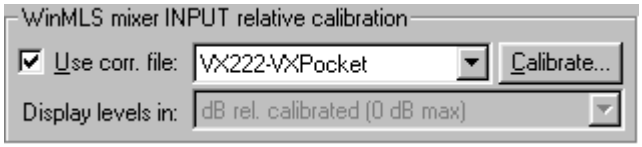
Settings... Displays the output absolute calibration settings dialog box as described below.



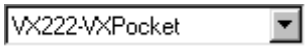
This dialog box is very similar to the **Input Level Calibration** displayed in the chapter above. For an explanation please refer to this chapter, or to the FAQ.

4.9.3 Relative calibration of mixer input

The WinMLS mixer controls the analog input amplifier of the sound card (some sound cards do not have a mixer, and some cards have a mixer that can not be controlled by WinMLS). The relative calibration uses a file containing the gain steps of the mixer for correction when the mixer gain is changed. So when a relative calibration has been done for the WinMLS mixer, changing the volume of the WinMLS mixer input will *not* affect the level of the measured transfer function. See FAQ for more information.



If checked, the relative calibration is performed using the correction file described below.



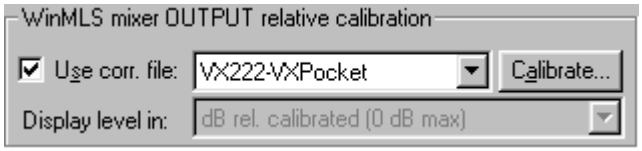
For selecting the correction file. If your sound card has two input lines, e.g. a microphone and line input, they will probably not have the same gain steps. Therefore, if you plan to switch measurement input line, the calibration file must be switched. How a correction file is generated is described below.

Click to generate a new input mixer correction file for the inputs and outputs selected in **Measurement->Sound Card Settings**. A dialog box will be displayed giving directions on how to perform the mixer input calibration. The procedure may take a few minutes. You will be notified when the calibration is finished.

Determines in what way the input levels are displayed. In the current version of WinMLS, it can only be displayed relatively with 0 dB as maximum (Full scale input). The maximum value of the input is found (within each average).

4.9.4 Relative calibration of mixer output

The relative calibration of mixer output is very similar to the relative calibration of mixer input. Please see chapter above for explanation.



4.9.5 Measurement System Correction

The influence of the measurement system can be corrected as described in the FAQ **How to correct for the influence of the measurement system?**

Selects the measurement system correction.

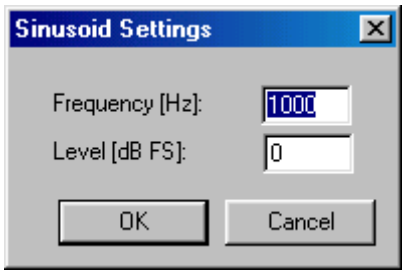
If this is checked, the full name of the measurement system correction files shown in the combo box above will be displayed.

4.10 Measurement Settings Toolbar

The **Measurement Settings Toolbar** is displayed if this is checked. The toolbar may also be turned on/off from the **View** menu. The reason for having this toolbar here is that the settings in this particular toolbar cannot be set from a dialog box, which is normal. And these settings should be found from the **Measurement** menu.

4.11 Sinusoid Settings…

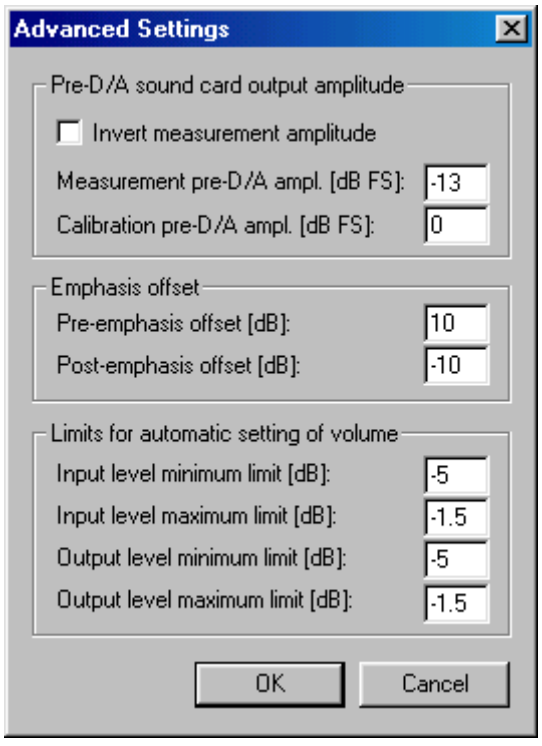
Displays the dialog box shown below used to set the frequency and level if sinusoid is selected as output signal.



The **Frequency** can be set no higher than half the sampling frequency. Note that if you close the dialog box and open it again, the frequency will have changed slightly from the value you have typed. This is because it has switched to the nearest possible exact frequency. The frequency resolution is increased by increasing the sequence order in the **Measurement Settings Toolbar**. The **Level [dB FS]** is the full scale level given in Decibels. Its maximum value is 0, which is the maximum amplitude for the Digital-to-Analog converter. The output level may be further adjusted using the volume settings.

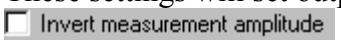
4.12 Advanced Settings

Displays the dialog box shown below.



4.12.1 Pre-D/A sound card output amplitude

These settings will set output:



Inverts the output signal if it is checked. If the measured impulse response has a negative peak, toggling this will invert the peak.

Measurement pre-D/A ampl. [dB FS]: -13 The edit box -13 gives the full-scale amplitude in Decibels of the measurement output signal (and for the *relative* sound card mixer calibration). Its maximum value is 0, which is the maximal amplitude for the Digital-to-Analog converter.

Calibration pre-D/A ampl. [dB FS]: 0 The edit box 0 gives the full-scale amplitude in Decibels of the signal used for *absolute* calibration of the sound card.

4.12.2 Emphasis offset

Pre-emphasis offset [dB]: 10 The pre-emphasis output amplitude is determined from this setting in combination with the Measurement pre-D/A ampl. [dB FS]: -13 (this is why we have called it *offset*). Depending on the selected type of pre-filtering, a too high value may cause the amplitude to exceed the maximal amplitude. If this causes clipping of the signal, an error message will be displayed.

Post-emphasis offset [dB]: -10 This is used to scale the recorded signal when measuring using post-emphasis.

4.12.3 Limits for automatic setting of volume

These settings will determine the limits when using **Measurement->Set Input Volume** and **Measurement->Set Input Volume**.

Input level minimum limit [dB]: -5 The volume is set so that the level is above this limit when using **Measurement->Set Input Volume**.

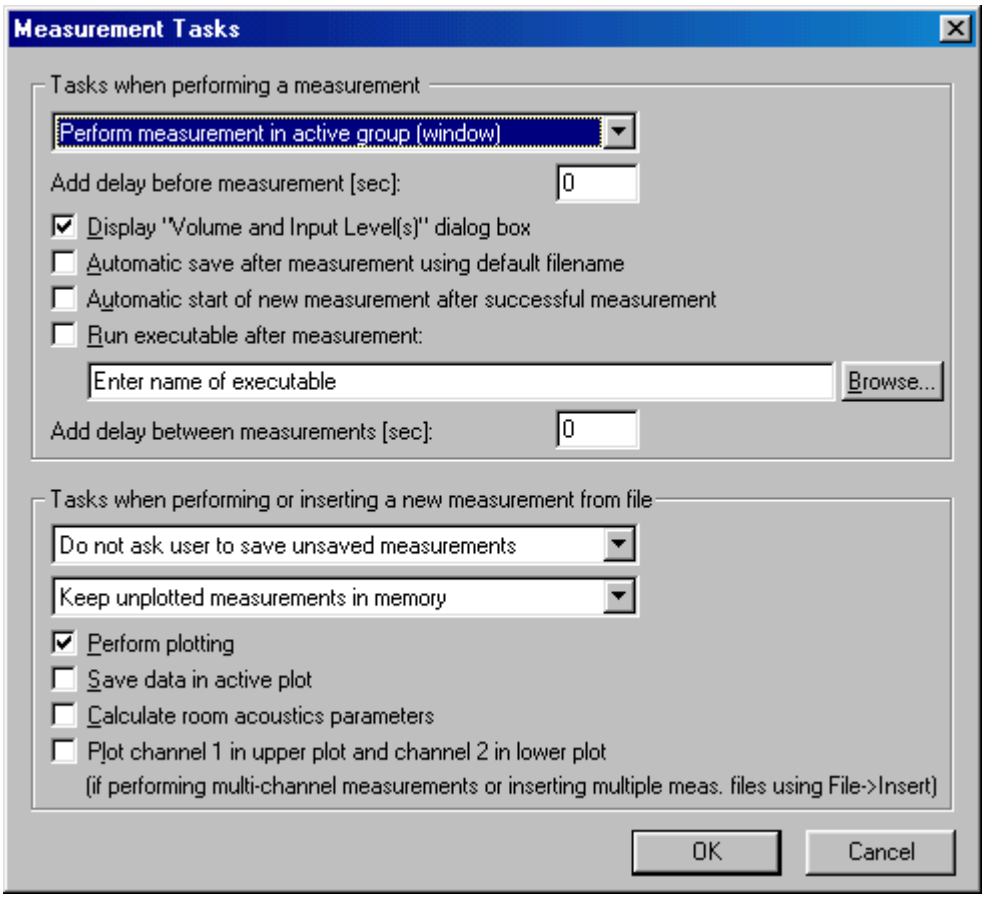
Input level maximum limit [dB]: -1.5 The volume is set so that the level is below this limit when using **Measurement->Set Input Volume**.

Output level minimum limit [dB]: -5 The volume is set so that the level is above this limit when using **Measurement->Set Output Volume**.

Output level maximum limit [dB]: -1.5 The volume is set so that the level is below this limit when using **Measurement->Set Output Volume**.

4.13 Measurement Tasks…

Displays the dialog box shown below used to determine what tasks are to be performed when a measurement is performed, inserted or opened.



4.13.1 Tasks when performing a measurement

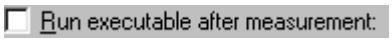
Perform measurement in active group (window) determines if a new measurement is to be performed in the active window or if a new window is to be opened. If **Perform measurement in new group (windows)** is selected, a new window will be opened when a new measurement is performed. This is similar to the two options you have when opening a measurement file. You may then choose between **Insert…** and **Open…**. **Insert…** will open the measurement file in the existing window, while **Open…** will open it in a new window

Add delay before measurement [sec]: 0 will add a delay after you start the measurement before it is actually performed. If you have to do something before each measurement and you don't have anyone to start the measurement for you, this delay after starting the measurement may be useful.

Display "Volume and Input Level(s)" dialog box determines if the dialog box found in **View->Volume and Input Levels(s) dialog** is to be displayed when a measurement is performed.

Automatic save after measurement using default filename determines if the measurement should be saved automatically using the filename and other parameters from **Measurement->Defaults for Saving…**.

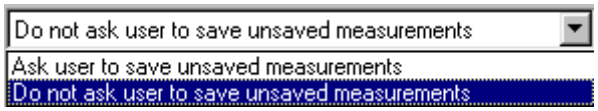
determines if a new measurement is to be started after performing a successful measurement. It makes it possible to perform several measurements without user interaction.



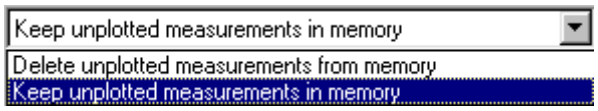
determines if an executable file is to be run after a measurement is performed. The name of the executable must be specified in the field below the check box. This may be used for controlling a turntable of type B&K®. For information about this, run the file **BKturntable.exe** found in the WinMLS folder.

adds a delay after the measurement has been performed. This may be useful when several measurements are performed in automatic mode.

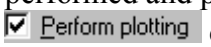
4.13.2 Tasks when performing or inserting a new measurement from file



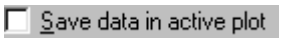
determines if a message box should pop up asking the user if the previous measurement is to be saved when performing or inserting a new measurement.



determines if the unplotted measurements should be kept in memory or not. If you are to perform several hundred measurements, you should be aware of that it might fill up the memory if they are not removed. Measurements are deleted by using **File->Delete Unplotted Measurements**, alternatively **Delete unplotted measurements from memory** will delete all measurements as long as they are not set as active or plotted. This prevents the memory to run full. It is useful if a repeated measurement is to be done and each measurement is never supposed to be stored. E.g. when calibrating a sound system, repeated measurements are needed but the results are not to be kept in memory. To sum up, this option deletes the previous unplotted measurements from memory after a new measurement has been performed and plotted.



determines if plotting is to be performed when a measurement is performed or inserted.



determines if the data in the active plot is to be saved after a measurement is performed or inserted. The filename of the text file depends on if the measurement has a file name or not. If the measurement does not have a filename, it is saved under the default folder given in **Measurement->Defaults for Saving**. The filename is "PlotMeasFromMem<Measurement number>.txt". If the measurement has a filename, it is saved using the measurement filename but with the extension **.txt**.
This is useful for batch-processing, e.g. if you want to compute the smoothed magnitude frequency response of several measurement files and send the data to a text files. This is done automatically by using **File->Insert**, then mark the measurements files you want to process and insert them.

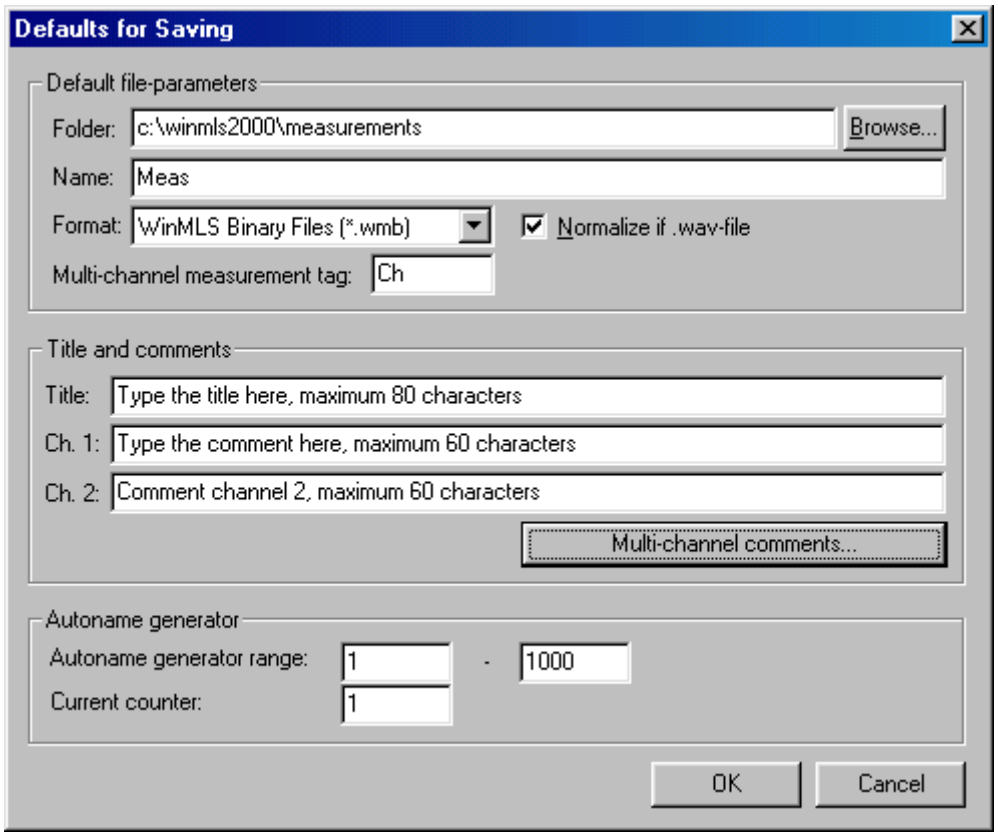
determines if room acoustics parameters are to be displayed and/or saved after a measurement is performed or inserted. The setting telling if it is displayed or saved to file or both is found in the bottom of the **Room Acoustics->Calculation Options…** dialog box.

The **Send to Text file** option is useful for calculating the room acoustics parameters of several files and saving the results in one operation. First check this option, then make sure **Send to Text-file** is checked in **Room Acoustics->Calculation Options…**. In **File->Insert**, select all the files that you want to process. If the measurement has a filename, it is saved using the measurement filename(s) but with the extension **.txt**. The filename of the text file depends on if the measurement has a file name or not. If the measurement does not have a filename, it is saved under the default folder given in **Measurement->Defaults for Saving**. The filename is "RoomAcMeasFromMem<Measurement number>.txt".

If this is turned off both channels in a 2-channel measurement are plotted in each plot. If you for example, view the impulse response in the upper plot and the magnitude frequency response in the lower plot, you normally want to do it this way. If the option is turned on and a 2-channel measurement is performed, channel 1 is plotted in the upper plot and channel 2 is plotted in the lower plot (if the window has two plots). This option is useful if you wish to view two plots having the same plot type. This is done in the room acoustics measurement setup file **RoomAcMeasurement**. Here the time-data plot type is displayed in both plots. When a two-channel measurement is performed, channel 1 is plotted in the upper plot and channel 2 is plotted in the lower plot. It makes it easy to compute room acoustics parameters that need two impulse responses, a primary and a secondary. The primary impulse response is taken from the upper plot, while the secondary is taken from the lower plot.
This also applies if two measurements are inserted using **File->Insert**. See the FAQ for more information.

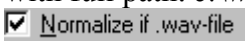
4.14 Defaults for Saving...

Displays the dialog box containing the defaults for saving measurements shown in the figure below. After a file is saved the default folder, format, title, comment(s) and current counter is updated.

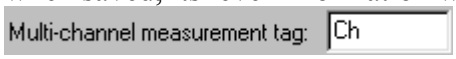


4.14.1 Default file-parameters

From here the default file folder, name and extension is set. Note that the default filename for saving will in addition contain a number given by the **Autoname generator** as will be described below. A single channel measurement using the settings above would get the suggested filename with full path: *c:\winmls2000\measurements\Meas_1.wmb*



should be checked if you want to normalize when saving to **.wav**-file. This should be done to ensure maximum quality. However, note that if the **.wav**-file is normalized when saved, its level information will not be correct.



gives the tab used for determining the filenames for a multi-channel measurement. A 2-channel measurement would, using the settings shown in the figure above, get the following two suggested filenames: *MeasCh1_1* and *MeasCh2_1*.

A multi-channel file will get the default name:

<default filename> + <multi-channel tab> + <channel number> + <_> + <measurement auto-numbering>

The reason for doing it in this order is to ensure flexible listing of the measurements in the Windows® file explorer. If you list the measurements using date, the multi-channel measurements will be listed after measurement number. If you list the measurements using filename, they will be listed after channel number since the channel is added before the measurement number.

4.14.2 Title and comments

Title and comments will be saved to the file header except for the **.wmt** format, which only saves the comment. The title has a maximum of 80 characters and the comment 60 characters.
The title will appear in the plot title if 

is checked in **Plot->Advanced Plot Settings…** and if  is checked on the **Standard Toolbar**.
The comment will appear in the plot title if 

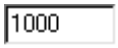
is checked in **Plot->Advanced Plot Settings…** and if  is toggled on the **Standard Toolbar**.
For a multi-channel measurement, comments may be given for each channel by clicking 

.

4.14.3 Autoname generator

The autoname generator is used to automatically assign a number to the suggested measurement filename.

The first edit box 

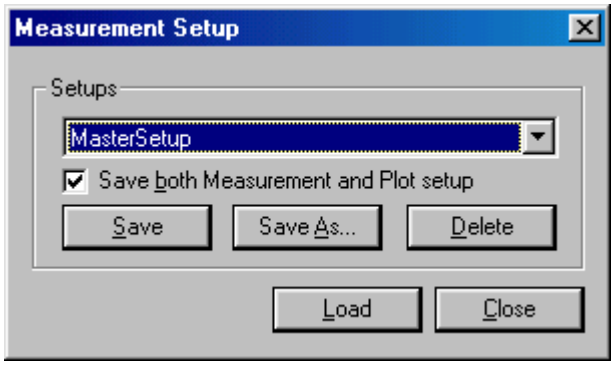
gives the start number of the auto-numbering. The second edit box 

gives the number where the auto-numbering ends. When this end-number is reached, the auto-numbering starts at the start number again. If you for example, are to perform 8 measurements that should have the same name, but numbered 1 to 8, you should set this to 8. Then when saving measurement number 9 the **Defaults for Saving** dialog box will be displayed and you may change the name.


displays the current value of the counter. E.g. after saving 5 measurements, the counter will have the value 5.

4.15 Measurement Setup...

Measurement setup defines as all the settings in the measurement menu.



When WinMLS is exited, the setup filename is saved in registry and all the current settings are saved to a temporary setup. The next time WinMLS is run, this setup file is opened and the settings restored.

To prevent the user from accidentally deleting or overwriting a setup file, the setup files may be write-protected.

4.15.1  Select setup

Displays the selected measurement setup. Setups are chosen from a list as shown in the figure below.

4.15.2 

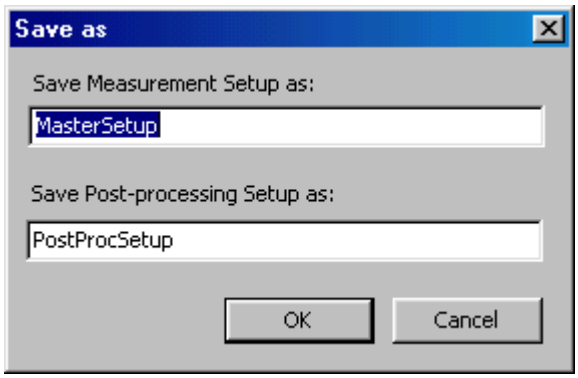
If this is checked, the post-processing setup is also saved when saving the measurement setup.

4.15.3  Save setup

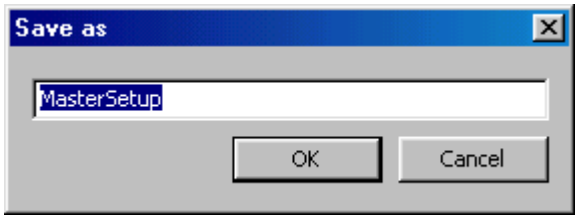
Saves the current measurement settings using the name in the **Setups** combo box.

4.15.4  Save setup as

Opens a dialog box for saving the current measurement settings.



If  is *not* checked, the post-processing setup will not be saved and the dialog box will look like in the figure below.



4.15.5 Delete setup

Deletes the selected setup.
The button is disabled when only one setup file is left to make sure not all setups are deleted.

4.15.6 Load setup

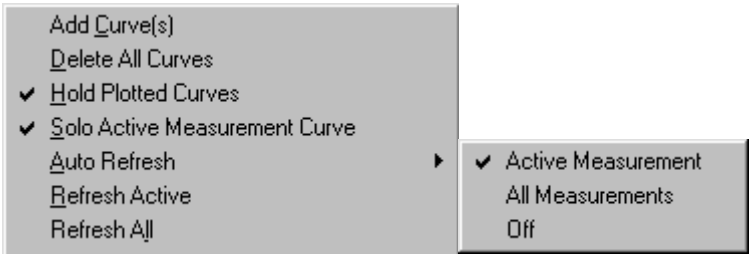
Loads the selected setup and then closes the **Measurement Setup…** dialog box. Note that you will not be asked to save the previous settings.

4.15.7 Close dialog

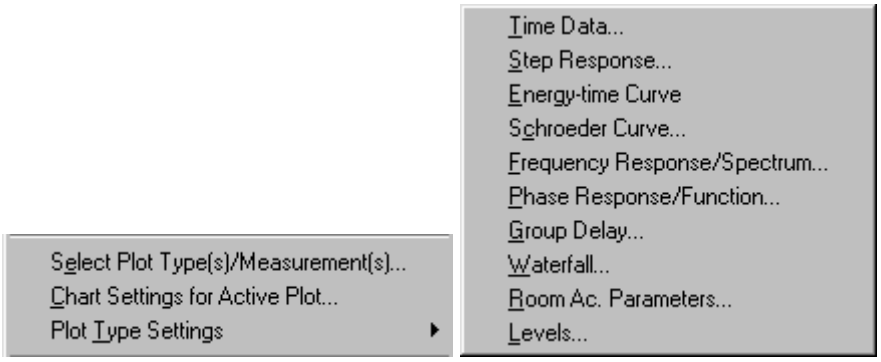
Closes the dialog box. No new setup will be loaded.

5 Plot

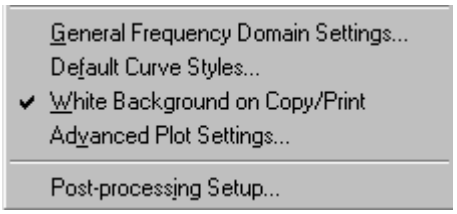
This menu contains all post-processing features, except for the room acoustics. The first part of the menu, as shown below, contains commands and settings for manipulating the plot(s).



The next part allows the user to select which plot type(s) to display and what measurement(s) to plot. It also contains chart settings that apply for the active plot only and settings that are specific for each plot type.



The last part contains various settings that applies to all plots, except for **General Frequency Domain Settings...** that applies for the frequency domain plot types only.



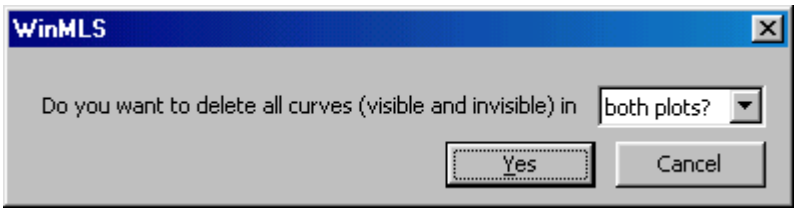
Each item is explained in detail below.

5.1 Add Curve(s)

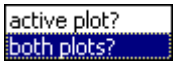
Adds new curves(s) to the *active* plot. The data is taken from the active measurement and normally one single curve is added. If a multi-channel measurement has been performed and is active, curves for all the channels are added. The curves are always added to the current plot independent on the **Plot->Hold Plotted Curves** setting. If it is desired to remove the old curves before adding new curve(s), then this can be done as described below by using **Plot->Delete All Curves**.

5.2 Delete All Curves

Deletes all curves in the active or both plots. The dialog box shown below is displayed.



You may choose to delete the curves in the active plot or in both plots (if two plots are present in the window).



5.3 Hold plotted curves

If this menu-item is checked, the existing curves in the plot(s) will remain in the plot when a new curve is plotted. If it is unchecked, the existing curves in the plot(s) will be deleted when a new curve is plotted. In the software MLSSA® and some other software holding plotted curves is called O*verplot*. Note that in WinMLS you may change the settings for the curves you have already plotted.

5.4 Menu: Solo Active Measurement Curve

If you have several curves in the plot and want to view only one curve temporarily, this “solo” setting can be used. If ”solo” is turned on, it hides all curves that do not belong to the active measurement.

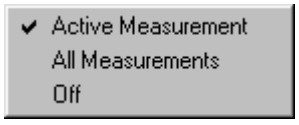
If there are several curves of the same active measurement, only the last plotted curve is visible. The other curves are not deleted from the plot, but are set invisible. They may easily be set visible again by turning “solo” off. If ”solo” is turned off, the curves that were visible before ”solo” was turned on are set visible again.

When **Plot->Refresh All** is selected or if auto-refresh is performed in *refresh all* mode, all the curves that are refreshed are set *visible*. This is because when refreshing all, it is likely that the user wants to display all the refreshed curves.

5.5 Auto Refresh

Auto-refresh will refresh the curve(s) if any settings influencing the viewed plot(s) are changed. Examples of settings that will cause auto refresh are the settings in the dialog box that pops up by clicking in the active plot, the toolbar buttons influencing the plotting and changing the time window size clicking and dragging the mouse.
Note that the settings in **Plot->Chart Settings for Active Plot...** are not controlled by the auto-refresh, as these settings are always immediately updated. E.g. if you change the plot background gradient colors in the **Plot->Chart Settings for Active Plot...** dialog box, this will be done immediately, even before closing the dialog box.

The type of refresh depends on what is checked in the sub-menu as shown below



Each of these is described below.

5.5.1 Active Measurement

If this is checked, the most recent curve of the active measurement is refreshed when changes in the settings are made. If the active window has two plots, both plots are refreshed. For details see documentation for **Plot->Refresh Active**.

5.5.2 All Measurements

If this is checked, the most recent curves of all measurements in the active window are refreshed when changes in the settings are made. If the active window has two plots, both plots are refreshed. For details see documentation for **Plot->Refresh All**.

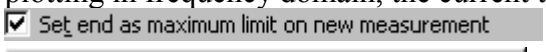
5.5.3 Off

If this is checked, no auto-refreshing is performed. But if a measurement is performed or inserted, it will be plotted. Refreshing must be done manually using **Plot->Refresh Active** or **Plot->Refresh All**. Set auto-refresh in **Off** modus if you wish to perform manual refreshing as will be described below. But note that if the settings in **Plot->Chart Settings for Active Plot...** are changed, this will immediately change the settings in the active plot.

5.6 Refresh Active

Refreshes the most recent curve of the active measurement in the active plot. **Refresh Active** is meant for use only when auto-refresh is turned *off*, see above. It is a "manual" refresh and gives the user somewhat more control. If the active window has two plots, only the active plot is refreshed. If no curve of the active measurement exists in the active plot, it will be added.

5.7 Refresh All

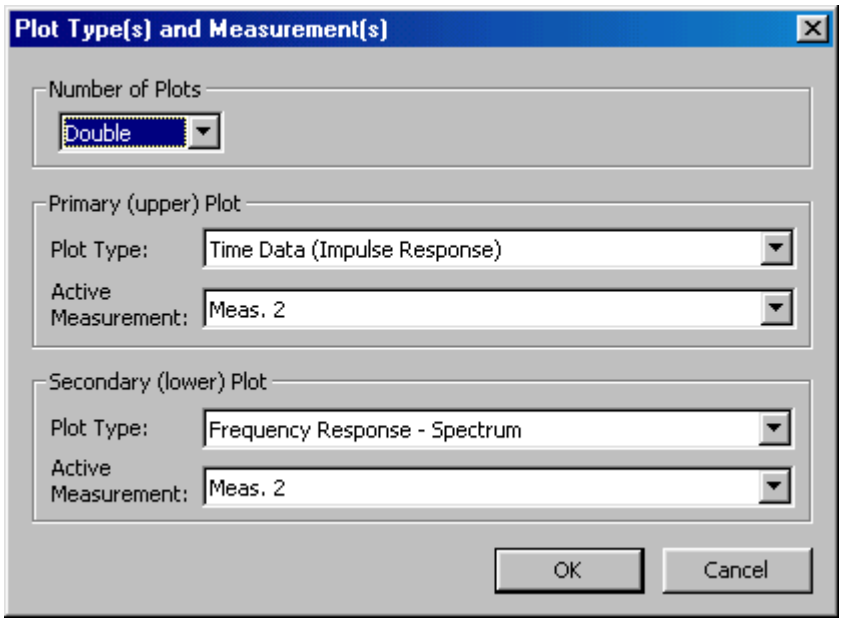
Refreshes the most recent curves of all measurements in the active plot. **Refresh All** is meant for use when auto-refresh is turned *off* or set in *Refresh Active* mode, see above. It is then useful if you change a setting and you want all curves to be updated with this setting. Note that if you are plotting in frequency domain, the current time data window size is used when refreshing, even if 

is checked (found by clicking 

in **Plot->General Frequency Domain Settings…**)
Note also that if several curves of a measurement are present in the plot, only the most recent curve will be updated. If the active window has two plots, only the active plot is refreshed. If no curve of the active measurement exists in the active plot, it will be added.

5.8 Select Plot Type(s)/Measurement(s)...

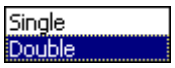
Displays the dialog box shown below for setting the plot type and active measurement in upper and lower plot.



The settings in this dialog box, may also be set from the **Plot Toolbar** and the **Measurement Selection Toolbar**.

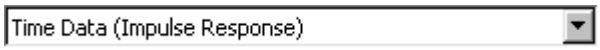
5.8.1 Number of plots 

Select if a single plot or two (double) plots are to be viewed as showed below.



5.8.2 Plot Type in Primary (upper) Plot

Selects the plot type from a list of all the available plot types. If two plots are displayed, this is for selecting the plot type in the *upper* plot.

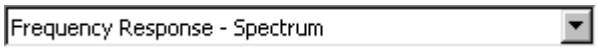


5.8.3 Active measurement in Primary (upper) Plot

Selects the active measurement from a list of all the performed or inserted measurements in the active window. If two plots are displayed, this is for selecting the active measurement in the *upper* plot.

5.8.4 Plot Type in Secondary (lower) Plot

Selects the plot type in the *lower* plot from a list of all the available plot types.

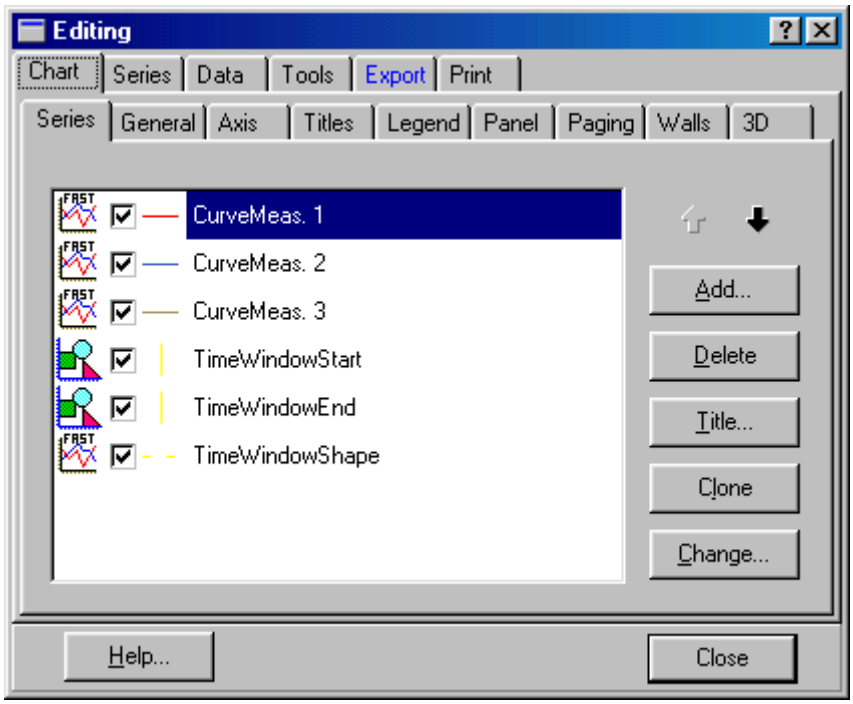


5.8.5 Active measurement in Secondary (lower) Plot

Selects the active measurement in the *lower* plot from a list of all the performed or inserted measurements in the active window.

5.9 Chart Settings for Active Plot...

Displays the dialog box shown below.



This dialog box gives many possibilities. The settings of this dialog box are saved to chart files for each plot type and are restored when the plot type is displayed. The chart files are found in the **Chart** subfolder in the folder where WinMLS is installed.
Note that changes in the plotted curve, e.g. changing colors, will not be saved. Default curve styles are set in **Plot->Default Curve Styles...**.

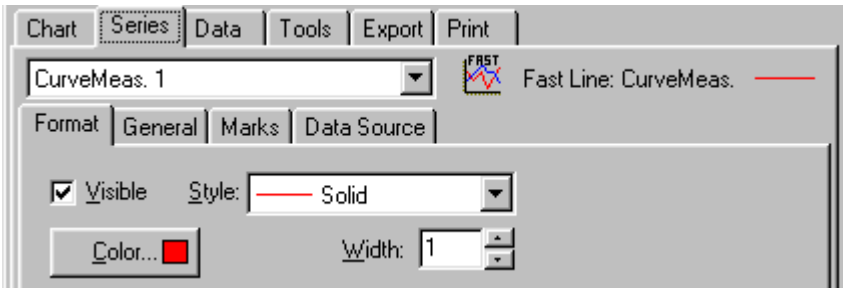
Now each tab page as shown in the figure below will be described, starting with the **Chart** page.

5.9.1 Chart page

This is the page that is displayed when opening the dialog box. It defines the overall display parameters for the active plot, such as background, axis, titles and legend. An explanation of some of these parameters is given in the FAQ document.

5.9.2 Series page

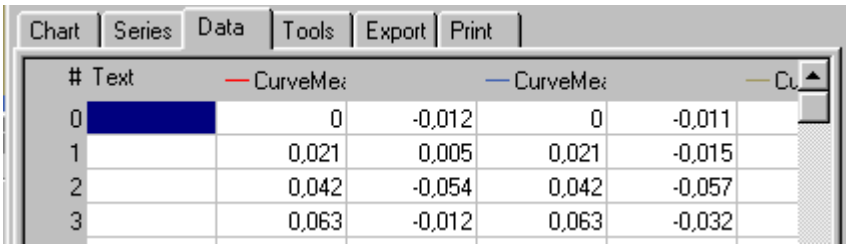
Gives access to the settings that applies to each curve (here it is called series) as shown below.



The Series page will contain parameters dependent on the series type concerned, and the available parameters will depend on the curve type chosen (in the figure above the curve type is **Fast Line**). The setting  at the top of the Series tab page shows which curve you are editing.

5.9.3 Data page

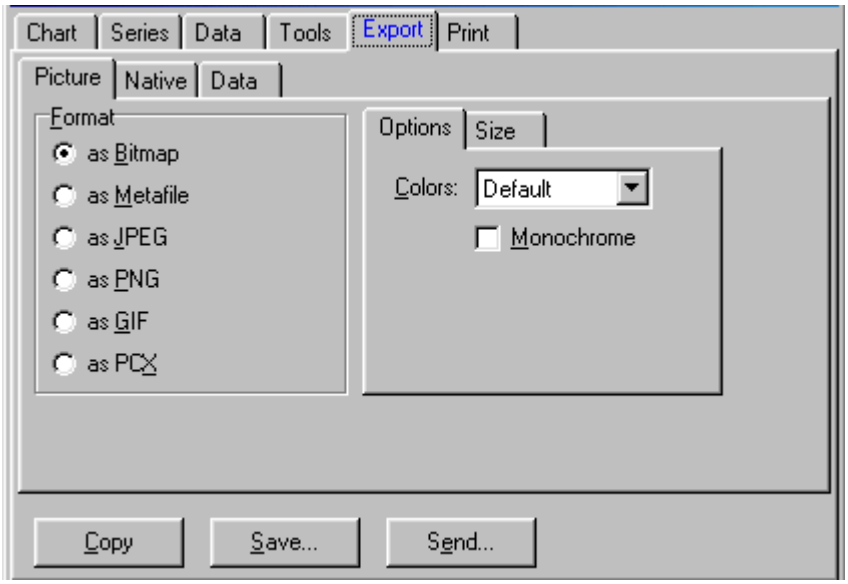
Gives access to the data (x- and y-values) of the active plot as shown in the figure below.



By clicking on the cells, the data may be deleted, changed or added.

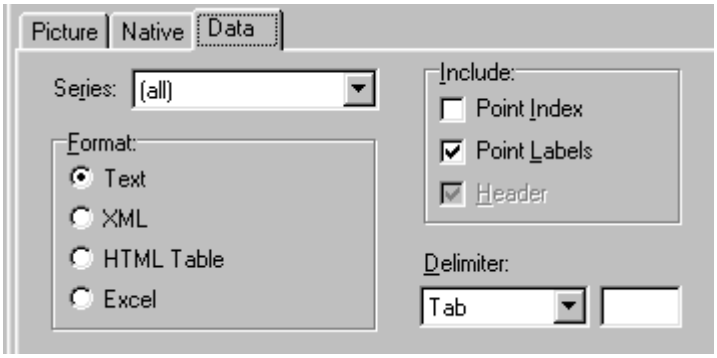
5.9.4 Export tab

Displays advanced setting for exporting the data in the active plot to picture formats.



Use the  button for saving.

If the Data tab is selected, advanced settings for exporting data is available as shown in the figure below.

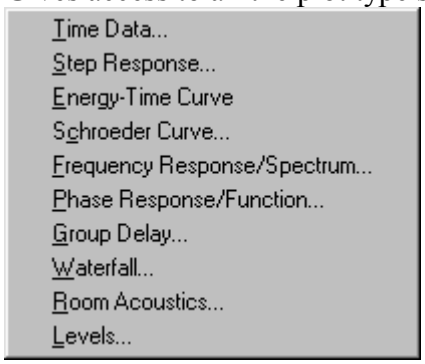


5.9.5 Print tab

The Print tab gives access to the same settings as **File->Print Preview…** and we recommend using that instead.

5.10 Plot Type Settings

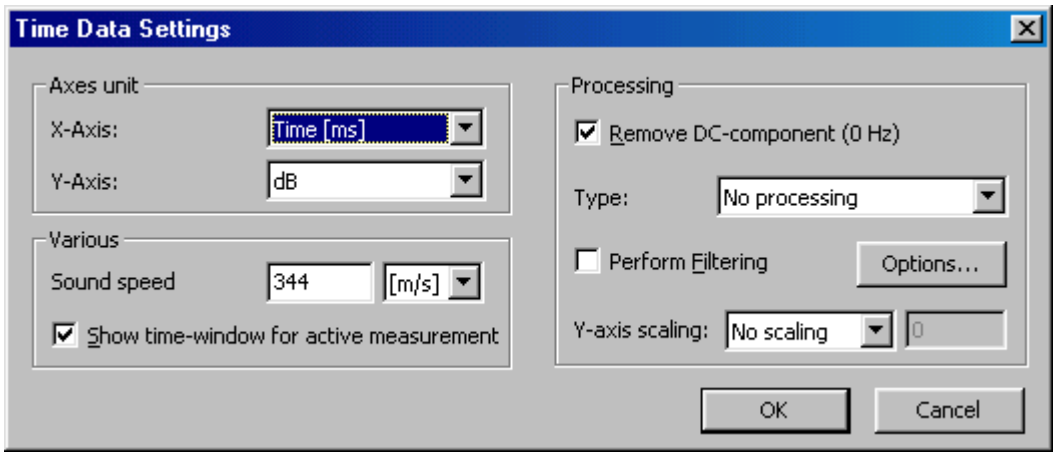
Gives access to all the plot type settings as shown in the figure below.



Note that double-clicking in the plot is a faster way to access the plot type settings for the active plot. The  button on the **Plot Toolbar** may also be used.
The settings for each plot type will be explained below.

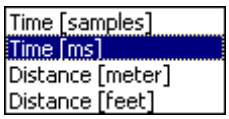
5.10.1 Time Data…

Displays the dialog box shown below.



5.10.1.1 X-axis settings

Selects the unit of the x-axis from one of the units displayed in the list shown below.

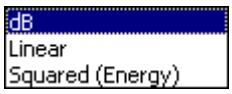


The chosen unit is also used in the user interface, e.g. as unit for the time window.

When the x-axis is changed, the upper and lower limits are will be properly scaled so the same segment of the curve(s) will be displayed. If several curves are plotted and the x-axis setting is changed e.g. from **Time [samples]** to **Time [ms]**, the curves will be updated using the **Plot->Refresh All** procedure.

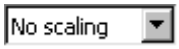
5.10.1.2 Y-axis settings

Selects the unit of the y-axis and the processing of the data from one of the choices displayed in the list shown below.

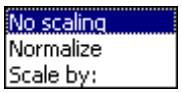


When the y-axis is changed, the upper and lower limits will be auto-scaled to make sure the curve(s) are appropriately viewed. If several curves are plotted and the y-axis setting is changed, the curves will be updated using the **Plot->Refresh All** procedure.

5.10.1.3 Y-axis scaling



Three types of scaling of the time data is supported as shown below.



No scaling – no scaling of the measurement.
Normalize – the measurement is normalized.
The amplitude of the absolute value of the time data is set to 1 if the y-axis is **Linear** or **Squared (Energy)**. It is set to 0 dB if the y-axis is **dB**. If performing a 2-channel measurement, do not use this normalization setting if it is desired to see the difference in levels between the impulse responses.
Scale by: 

- scales the measurement with the given factor. If the y-axis is **Linear**, the measurement is multiplied with the factor. If the y-axis is **Squared (Energy)**, the measurement is first squared and then multiplied with the factor. If the Y-axis is **dB**, the measurement is *shifted* (not scaled) with the factor.

5.10.1.4 Velocity of sound 

Gives the velocity of sound and the unit.
Two units may be chosen:

The velocity of sound is used to compute the x-axis unit if **Distance [meter]** or **Distance [feet]** is chosen for the time domain plot types. It is also used to compute the quarter, half and whole wavelengths displayed in the **Status Toolbar** for the frequency domain plot types.

Note that if you are performing vibrational measurements, e.g. using an accelerometer instead of a microphone, it is the velocity of propagation in the structure that is to be typed, not the sound velocity.

Note that changing the velocity of sound in this dialog box will also affect the other time domain plot types, such as energy-time-curve.

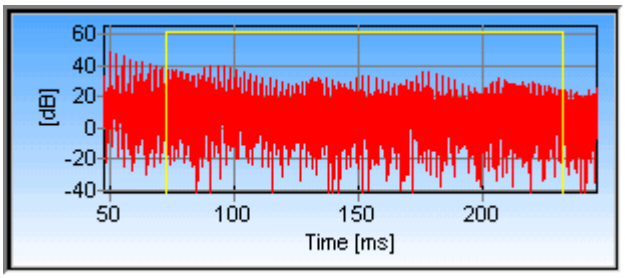
The speed of sound, denoted *c*, may be found if the temperature is known using the formula

$c = (331.4 + 0.6*T)$

where T is the temperature in centigrade.

5.10.1.5 Show time window for active measurement

If checked, the *time data window* is displayed in the **Time Data** plot type as shown below. The *time data window* consists of the three yellow straight lines and it is valid for the active measurement. (there may be more than one measurement in the window and these may have different *time data windows*).



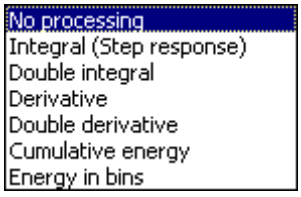
The window start and end points can be set directly by clicking and dragging with the mouse. In order to do this, the mouse pointer has to be exactly on top of the vertical line that is to be moved. The mouse pointer changes shape when it comes close to the limit.
In order to make sure auto-scaling of the y-axis can be effectively used, the vertical start and end lines are kept within the curve area. (The length is 10% larger than the minimum of the curve with the smallest y-value, and 10% less than the maximum of the curve with the greatest y-value.) The whole window is thus visible if auto-scaling is used.

5.10.1.6 Remove DC-component (0 Hz)

☑ Remove DC-component (0 Hz) If checked, the DC-component will be removed when plotting.
The DC-component is removed by subtracting the DC-component of the last half of the measurement data.

5.10.1.7 Processing Type

No processing ▼ This contains the processing options showed below



5.10.1.7.1 No processing

No extra processing is done on the measurement data.

5.10.1.7.2 Integral (Step response)

Integrates the measurement data. This is useful for example if you are measuring velocity but want to display displacement. If the measurement is an impulse response, the result is a step response. This is because the integral of an impulse response is a step response.
When performing integration, the DC-component should be removed, so make sure ☑ Remove DC-component (0 Hz) is checked.
Instead of using this integration option, you may use the plot type named **Integrated Time Data (Step Response)**.
The numerical integration is performed by cumulative summing of the elements. This gives a time shift error of one half sample which gives a linear phase shift. No correction for this is

performed, but it may be done using the **Subtract delay** check box in the phase response/function plot type settings.

5.10.1.7.3 Double integral

Computes the double integral of the measurement data. This is useful for example if you are measuring acceleration but want to display displacement.
When performing the double integration, the DC-component should be removed, so make sure ☑ Remove DC-component (0 Hz) is checked.
The numerical double integration is performed by twice cumulative summing of the elements.

5.10.1.7.4 Derivative

Computes the derivative of the measurement data. This is useful for example if you are measuring displacement but want to display velocity.
The numerical derivation is performed by taking forward differences on the left and right edges and taking cantered differences on interior points.

5.10.1.7.5 Double derivative

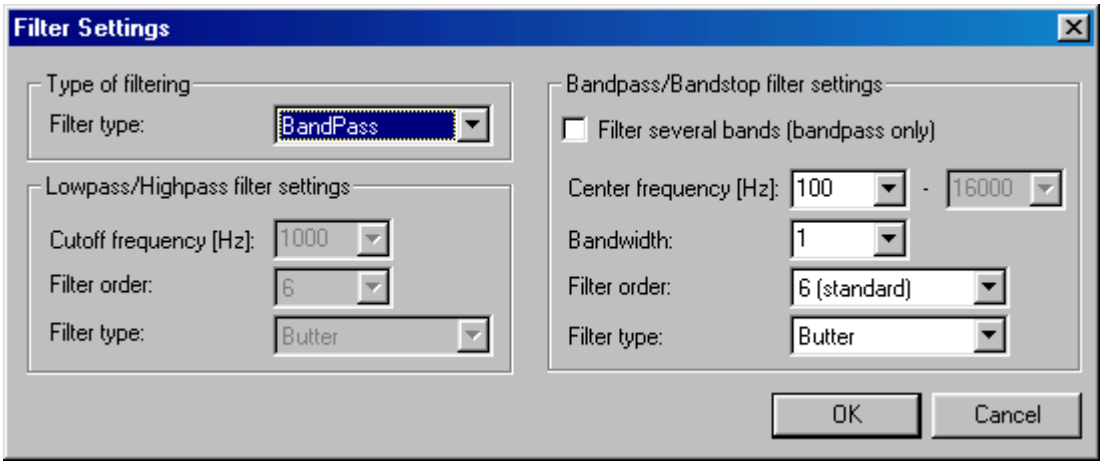
Computes the double derivative of the measurement data. This is useful for example if you are measuring displacement but want to display acceleration.
The numerical double derivation is performed by computing the derivative as described above twice.

5.10.1.7.6 Cumulative energy

Computes the cumulative energy of the measurement data.
The computation is performed by first computing the energy, then cumulative summing of the energy elements.

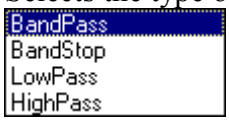
5.10.1.8 Filtering

If ☐ Perform Filtering is checked, filtering of the measurement is performed according to the filtering options Options... as shown below.



5.10.1.8.1 Type of filtering

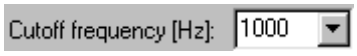
Selects the type of filtering from the list below



A BandPass filter lets the frequencies within a band pass and suppresses the other. A BandStop filter suppresses the frequencies within a band and lets the other frequencies pass. A LowPass filter lets low frequencies pass and suppresses the high frequencies. A HighPass filter does the opposite.

5.10.1.8.2 LowPass/HighPass filter settings

This group contains the settings if the type **LowPass** or **HighPass** has been selected.



Specifies the cut-off frequency of the filter. The frequency may be typed or selected from the list of standard 1/3-octave frequencies.

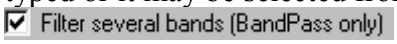
Specifies the filter order. The order is selected from the list and has the range 1-14.

Specifies the filter type. In the current version of WinMLS, only the type **Butter** is supported.

5.10.1.8.3 BandPass/BandStop filter settings

This group contains the settings if the type **BandPass** or **BandStop** has been selected.

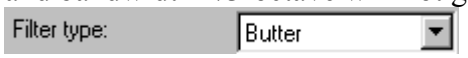
If BandPass is the filter type and this is checked, several bands may be filtered and thus several curves are plotted depending on the start and stop frequency and the octave fraction bandwidth. How to determine the bands is explained below.
Note that if **Filter several bands** is checked, it is *strongly recommended* to make sure **Plot->Hold plotted curves** is unchecked. This is because many curves will be generated, and the refreshing does not handle this special case with several curves of one measurement. **Plot->Refresh Active** and **Plot->Refresh All**, will add new curves and not replace the old ones.

Determines the centre frequency. Any frequency may be typed or it may be selected from the list of standard 1/3-octave frequencies. If


is checked and the filter type is BandPass, two frequency values are to be selected, the start and end centre frequencies. The number of curves to be plotted within this frequency range is given by the **Bandwidth** described below. If the bandwidth is set to 1 octave or 1/3 octave, the standard frequencies within the specified frequency range is used. For other bandwidth settings the centre frequencies are calculated beginning at the start centre frequency.

Determines the filter octave bandwidth. Any bandwidth may be typed or it may be selected from the list. A bandwidth of 1 octave is according to the ISO 3382 standard.

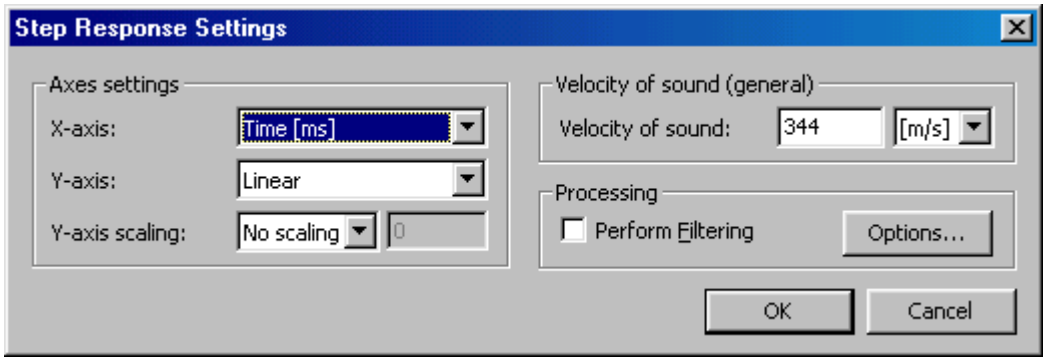
Specifies the filter order. The order is selected from the list and has the range 2-14, only even numbers. Filter order 6 is according to the ISO 3382 standard. If the order is greater than 6 it does not give a stable result for low frequencies, e.g. filter order 8 and bandwidth 1/3-octave will not give a stable filter below a centre frequency of 350 Hz.



Specifies the filter type. In the current version of WinMLS, only the filter type **Butter** is supported which complies with the ISO 3382 standard.

5.10.2 Integrated Time Data (Step Response)...

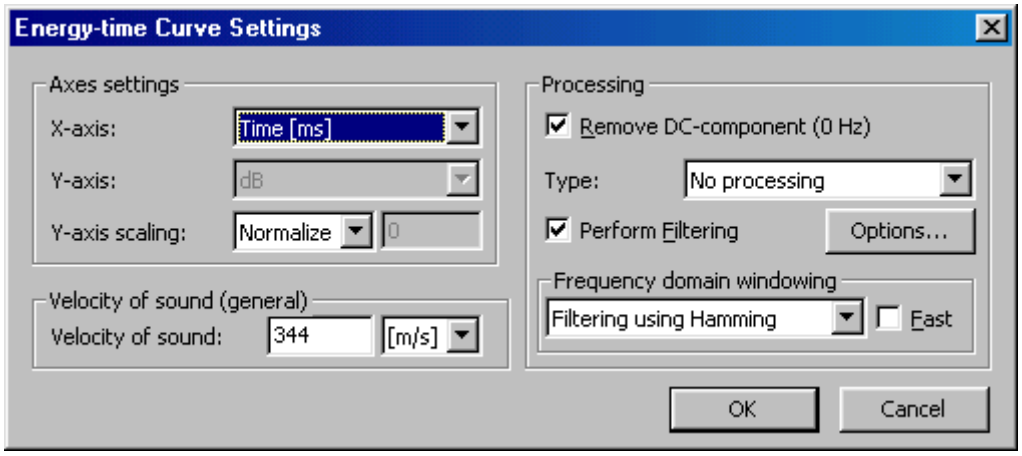
Displays the dialog box shown below.

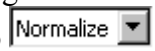


All the settings of this dialog box are explained in the Time Data plot type documentation.

5.10.3 Energy-time Curve

Displays the dialog box shown below



Most of the Energy-time Curve settings are found and described under the Time Data plot type settings. But for the Energy-time Curve the y-axis can only be plotted in **dB** (the y-axis scaling is set to 

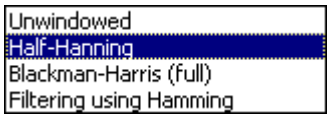
which is the most common way to view the Energy-time Curve). The **Frequency Domain Windowing** settings are also unique for this plot type and are explained below.

5.10.3.1 Frequency domain windowing

The Energy-time Curve is computed by first transforming from time domain to frequency domain.

If Fast is checked, this transform is performed faster using a Fourier transform with a data length of an order of two. The data are padded with zeros to get this length. This may introduce an error if a DC-component exists.

After the Fourier transform, a window may be applied to the complex frequency data before performing the inverse transform. The following choices are possible:



5.10.3.1.1 Unwindowed

No frequency domain windowing is performed. All frequencies are given equal weight.

5.10.3.1.2 Half-Hanning

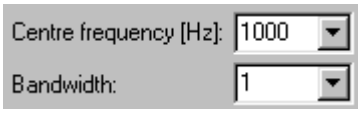
A Half-Hanning window is applied in *frequency* domain. This results in an attenuation of the higher frequencies. This option is recommended for loudspeaker measurements.

5.10.3.1.3 Blackman-Harris (full)

A Blackman-Harris full window is applied in *frequency* domain. This results in an attenuation of both the lower and higher frequencies, while the mid-band frequencies are not attenuated.

5.10.3.1.4 Filtering using Hamming

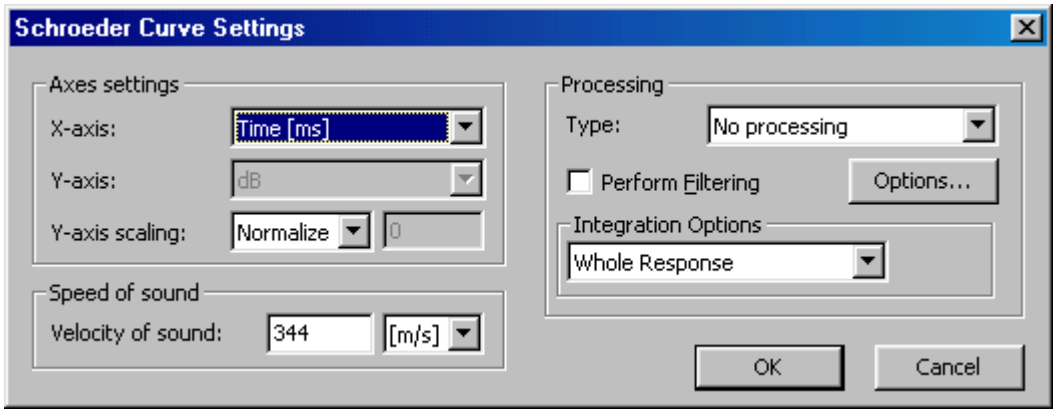
A Hamming window is applied in frequency domain. Note that if this is selected, the usual filtering controlled by Perform Filtering will not be applied. However, the centre frequency and the bandwidth for the Hamming windowing is taken from the filtering options, accessed by clicking Options... . In the dialog box, the centre frequency and bandwidth are set as shown below.

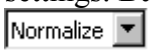


Using the settings above will give the most weight to the frequencies around 1000 Hz and filter out all frequencies below 707 Hz and above 1414 Hz.

5.10.4 Schroeder Curve…

Displays the dialog box shown below.



Most of the Schroeder Curve settings are found and described under the Time Data plot type settings. But the Schroeder Curve y-axis can only be plotted in **dB** (the y-axis scaling is set to 

which is the most common way to view the Schroeder Curve). The DC-component is removed for the Schroeder curve and it is computed from the last 50% of the measurement data. The **Integration Options** settings are also unique for this plot type and are explained in the chapter below.
The Schroeder curve is backwards integration of the impulse response. When computing the Schroeder Curve, the start of the impulse response is detected. The Schroeder curve is used to find the reverberation time as described further in the Room Acoustics User's guide.

5.10.4.1 Integration Options

The integration options are described in the Room Acoustics User's Guide.

The integration options are:

1. *Whole response*
   Integration using the whole impulse response, no noise analysis carried out..

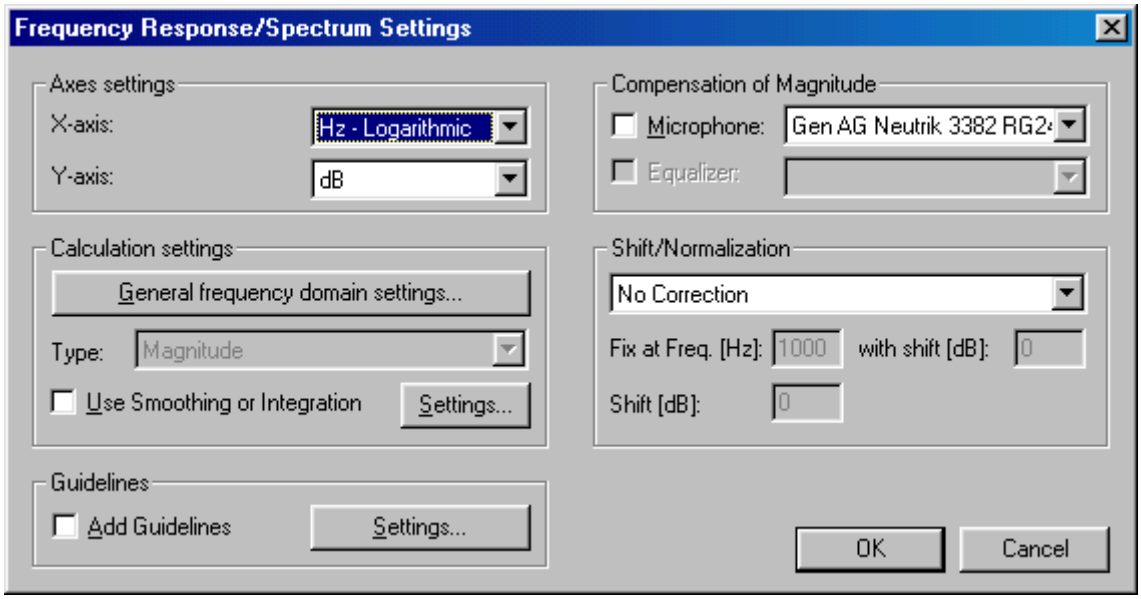
2. *Truncation*
   Integration of the impulse response, truncated at or above the crosspoint between the response and the stationary noise floor.

3. *Truncation and compensation*
   Integration of the impulse response, after truncation at or above the crosspoint between the

response and the stationary noise floor, compensated for the truncated energy. This is recommended if the measurements are of reasonably high quality.

5.10.5 Frequency Response/Spectrum...

Displays the dialog box shown below.

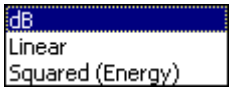


5.10.5.1 X-axis settings

Selects the unit of the x-axis from one of the units displayed in the list shown below.

5.10.5.2 Y-axis settings

Selects the unit of the y-axis and the processing of the data from one of the choices displayed in the list shown below.



If several curves are plotted and the y-axis setting is changed, the curves will be updated using the **Plot->Refresh All** procedure.

5.10.5.3 General Frequency Domain Settings

Click the button 

to open the dialog box also accessed from **Plot->General Frequency Domain Settings…**.

5.10.5.4 Type

Select the type of frequency response/spectrum.

In the current version of WinMLS, only **Magnitude** is supported.

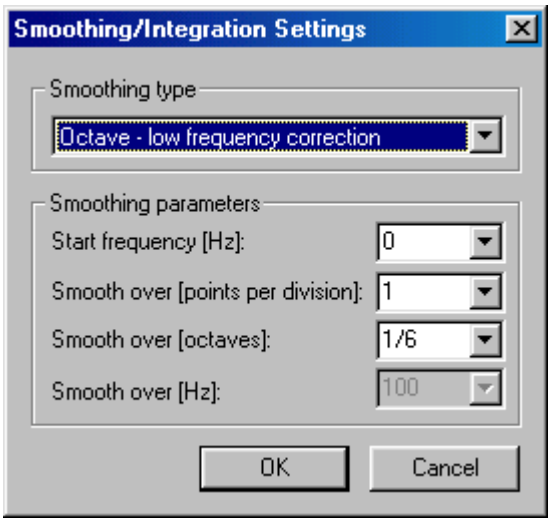
5.10.5.5 Smoothing or Integration

If the check box shown below is checked, frequency domain smoothing or integration is performed.

The type of smoothing or integration is set from the 

button and is described below.

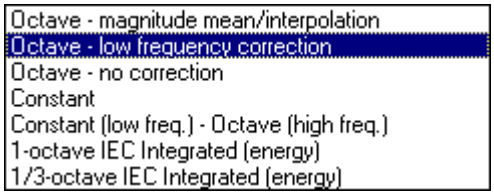
5.10.5.5.1 Smoothing Settings



Smoothing calculates the mean of frequency response magnitude values over a sliding frequency band. The band is usually set in octaves (e.g. 1/3 octave wide) to give an equal distribution along a logarithmic frequency axis. A linear band may also be used and may be useful if a linear frequency axis is used.
Smoothing in power is the standard method of smoothing if it is applied on magnitude frequency response or spectrum. The mean of the squared amplitude values are computed. But you may also smooth to get the mean in magnitude instead of the mean in power, by setting the smoothing type to **Octave – magnitude mean/interpolation**. Another feature of this setting is the interpolation, that means that it finally interpolates the calculated smoothed values to the frequency points used if no smoothing was applied. Smoothing may increase the calculation time.
If the dialog box is opened from the Frequency Response/Spectrum plot type settings dialog box, integration may be chosen instead of smoothing.

5.10.5.5.1.1 Smoothing type

The types of smoothing are shown in the list below. The two integration options at the bottom of the list shown below are only available if the **Smoothing settings** dialog box is opened from the **Frequency Response/Spectrum** settings dialog box.



5.10.5.5.1.1.1 Octave – magnitude mean/interpolation

Smoothing in magnitude mean. After smoothing, the calculated smoothed values are interpolated to the frequency points used if no smoothing was applied. In **Smoothing parameters** described below, the bandwidth is set. Because of the interpolation, this is the slowest method of smoothing.
This smoothing algorithm has been contributed by Dr. Aki Mäkivirta, Genelec Oy.

5.10.5.5.1.1.2 Octave - low frequency correction

Octave smoothing with a correction for low frequencies. If the number of points within the smoothing window is less than 3, then the data is plotted without being smoothed. This will avoid the stair-like shapes for low frequencies sometimes seen if using the option **Octave – no correction**. If magnitude frequency response or spectrum is plotted, the energy is smoothed, not the mean or Decibel. In **Smoothing parameters** described below, the parameters for this smoothing type are selected.
For high frequencies, the smoothing is stopped when there is not enough bandwidth for a full smoothing. E.g. if 1 octave is chosen and Fs=48000, the highest frequency would be (Fs/2) *2^(-1/2)= 16.9 kHz. For 1/3 ovtave it would be(Fs/2) *2^(-1/6) = 21.4 kHz.

5.10.5.5.1.1.3 Octave - no correction

This option is the same as above, except that no low frequency correction is performed.

5.10.5.5.1.1.4 Constant

Constant bandwidth smoothing. Suited if the data it plotted using a linear frequency axis. Note that the starting frequency is at half the constant bandwidth. E.g. if **Smooth over [Hz]** in **Smoothing parameters** is set to 100, the first frequency plotted is at 50 Hz.

5.10.5.5.1.1.5 Constant (low freq.) - Octave (high freq.)

This method does **Constant** bandwidth smoothing up to **Start frequency [Hz]** (see below). Above this frequency it is **Octave** smoothing.

5.10.5.5.1.1.6 1-octave IEC Integrated (energy)

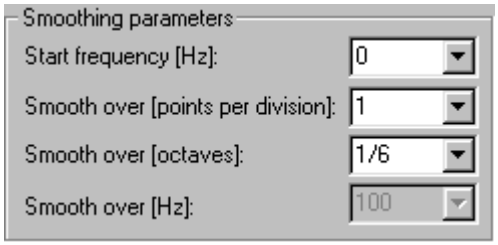
Plots the energy in octave bands.
This option is available only if the **Smoothing settings** dialog box is opened from the **Frequency Response/Spectrum** settings dialog box.

5.10.5.5.1.1.7 1/3-octave IEC Integrated (energy)

Plots the energy in 1/3-octave bands.
This option is available only if the **Smoothing settings** dialog box is opened from the **Frequency Response/Spectrum** settings dialog box.

5.10.5.5.1.2 Smoothing parameters

Contains the parameters for the various types of smoothing described above. Parameters that are not used for the chosen smoothing type are disabled.



5.10.5.5.1.2.1 

Determines the frequency where the smoothing starts. Below this frequency, nothing is plotted if the smoothing type is **Octave - low frequency correction**, **Octave - no correction** or **Constant**. If the smoothing type is **Constant (low freq.) - Octave (high freq.)**, then constant bandwidth smoothing is performed below this "start frequency" and octave smoothing is performed above.

5.10.5.5.1.2.2 

Determines how many points are to be computed and plotted within each division. The value may be typed or chosen from the list. If the smoothing type **Octave - low frequency correction** or **Octave - no correction** is selected, it gives the number of points within the octave fraction band specified (see **Smooth over [octaves]**). There are more points at high frequency when plotting on a logarithmic x-axis, but using this method we end up with a constant number of points over the whole frequency range. The software SMAART® uses the term Fixed Points Per Octave (FPPO). If the smoothing type **Constant** is selected, it gives the number of points within the constant band specified (see **Smooth over [Hz]**).
If the number is larger than 1, it is the same as doing a sliding window smoothing because the windows will overlap.

5.10.5.5.1.2.3 

Determines the smoothing bandwidth in octaves. The value may be typed or chosen from the list. This is used if the smoothing type is **Octave - magnitude mean/interpolation**, **Octave - low frequency correction**, **Octave - no correction** and for the octave smoothing part of **Constant (low freq.) - Octave (high freq.)**.

5.10.5.5.1.2.4 

Determines the constant smoothing bandwidth in Hertz. The value may be typed or chosen from the list. This is used if the smoothing type is **Constant** and for the constant bandwidth smoothing part of **Constant (low freq.) - Octave (high freq.)**.

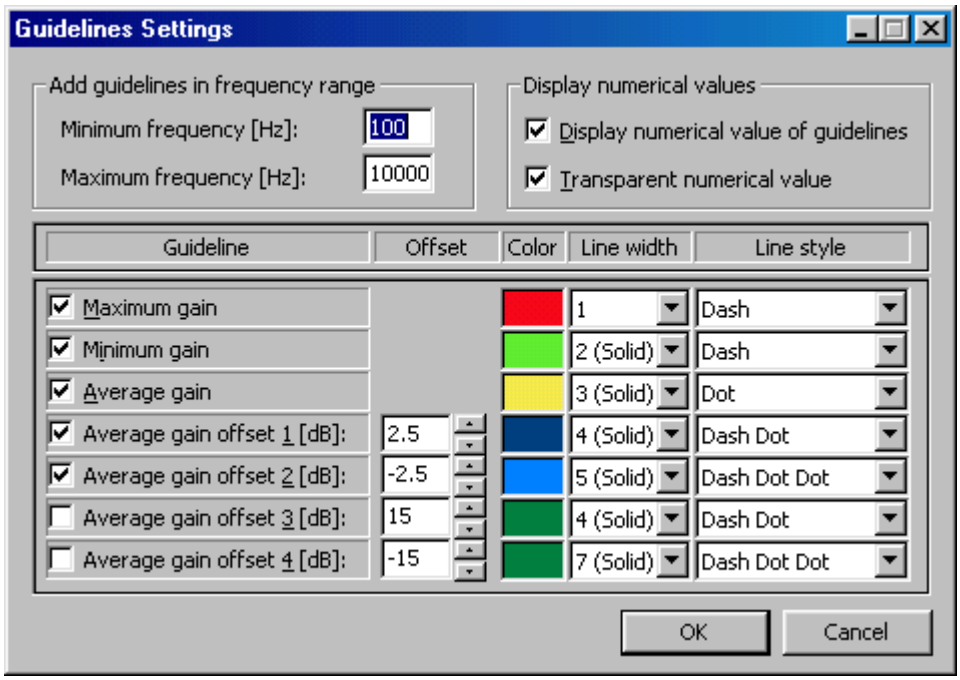
5.10.5.6 Guidelines

If  is checked, guidelines are added to the active measurement. If it is unchecked, guidelines that are in the plot will be deleted.

The type of guidelines is set from the  button and is described below.

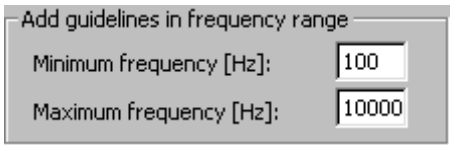
5.10.5.6.1 Guidelines settings

Guidelines for displaying maximum gain, minimum gain, average gain, and up to four different average gain offsets are supported.



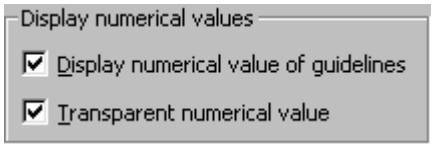
5.10.5.6.2 Frequency range

Sets the frequency range where the guidelines are to be displayed. The maximum guideline frequency is truncated if it is greater than the maximum frequency of the active plot.



5.10.5.6.3 Display numerical values

Determines if numerical values are to be displayed on the guidelines and if they are to be transparent or have a yellow field around the value.



5.10.5.6.4 Guideline

5.10.5.6.5  Maximum Gain

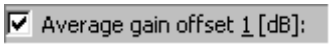
If checked, a horizontal line is drawn where the maximum of the active measurement magnitude frequency response curve is found within the frequency range given by the minimum and maximum frequency.

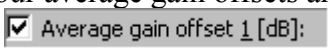
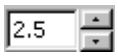
5.10.5.6.6  Minimum Gain

If checked, a horizontal line is drawn where the minimum of the active measurement magnitude frequency response is found within the frequency range given by the minimum and maximum frequency.

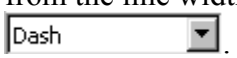
5.10.5.6.7  Average Gain

If checked, a horizontal line is drawn where the average of the active measurement magnitude frequency response is found within the frequency range given by the minimum and maximum frequency.
Note that the average is computed from the plotted data (e.g. if the data are plotted in Decibels, the average will be computed from the Decibels data).

5.10.5.6.8  Average gain offset.

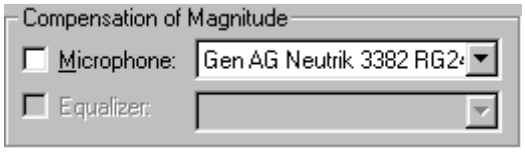
Four average gain offsets are available.
If  is checked, a horizontal line will be drawn at the average value added an offset given by the  setting to the right of the check box.

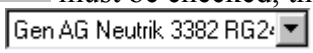
5.10.5.6.9 Guideline style

The color of the guidelines is set by clicking at the color field  . The line width is selected from the line width  list box. The line style is selected from the line style list box  . Note that if the line width is greater than the smallest width, which is 1, the line style can only be **Solid**.

5.10.5.7 Compensation of Magnitude

Compensation of the magnitude frequency response is possible. In the current version of WinMLS, one compensation is possible and it is called microphone compensation, but any other compensation may be done instead. Note that the Equalizer compensation is always disabled).



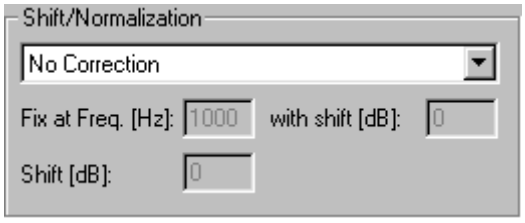
In order to do the compensation  must be checked, then the file containing the compensation data must be selected from  .
If no such file exists, it can be made.
An example of the format of the file is shown below. First a line containing the title, then a line with the title of each of the two columns, then the data columns, frequency column first followed by the magnitude frequency response data.

"Transfer Function Mag - dB volts/volts (0.33 oct)"
"Hz" "Data"
13.81928, 5.60038
18.42571, 5.60038
23.03213, 5.60038
32.24499, 5.60038
….

The frequency separation has no restrictions, spline interpolation is used to get the needed frequencies.

5.10.5.8 Shift/Normalization

Makes it possible to shift or normalize the curve.



determines the type of shift/normalization and has the possibilities shown and explained below.

5.10.5.8.1 No Correction

No shifting/normalization is performed.

5.10.5.8.2 Normalize to 0 dB

The curve is shifted so largest value is 0 dB.

5.10.5.8.3 Fix to Frequency Value

The curve is shifted so that at a specified frequency it is given a specified value. In the figure below, the specified frequency is 1000 Hz and at this frequency the curve is shifted so the value is 0 dB.

Note that if the y-axis is set to **Linear** or **Squared (energy)**, the shift will still be given in dB, so a shift of 0 dB will give the value 1.

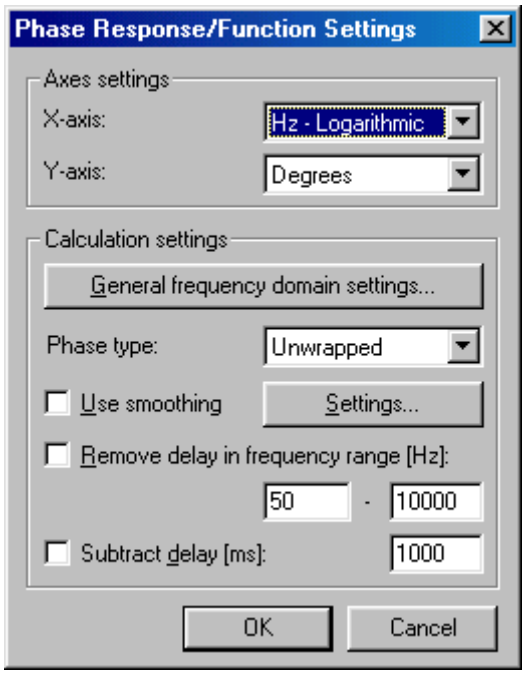
5.10.5.8.4 Shift

The curve is shifted, and the amount of shifting in dB is given below.

Note that if the y-axis is set to **Linear** or **Squared (energy)**, the shift will still be given in dB, so a shift of 20 dB is the same as multiplying the **Linear** value by 10 and the **Squared (energy)** by 100.

5.10.6 Phase Frequency Response/Function...

Displays the dialog box shown below.



Note that the phase is influenced by the sound card response. This may be removed by using the measurement system correction feature. Most sound cards have a delay of some samples that give a linear phase shift. It is possible to remove a pure delay by using the delay removal and subtraction features of this dialog box.
The microphone will also influence the phase, to get an accurate phase, use a precision microphone with as high a bandwidth (higher than the measurement frequency range) and flat frequency response as possible.

5.10.6.1 X-axis settings

Selects the unit of the x-axis from one of the units displayed in the list shown below.

5.10.6.2 Y-axis settings

Selects the unit of the y-axis and the processing of the data from one of the choices displayed in the list shown below.

If several curves are plotted and the y-axis setting is changed, the curves will be updated using the **Plot->Refresh All** procedure.

5.10.6.3 General Frequency Domain Settings

Click the button 

to open the dialog box also accessed from **Plot->General Frequency Domain Settings…**.

5.10.6.4 Phase type

Selects the type of phase from the list below.

Minimum and excess phase are viewed unwrapped and smoothing (explained below) is performed as the last computation if it is checked.

5.10.6.4.1 Wrapped phase

Restricts the phase range to –180 to +180 degrees, or $-\pi$ to $+\pi$ if radians is chosen as y-axis. The phase of a measurement will usually exceed this range, which results in jumps in the phase.

5.10.6.4.2 Unwrapped phase

The unwrapped phase is not restricted to the *wrapped* range, and has no jumps. The unwrapped phase is computed from the wrapped phase by changing absolute jumps greater than 180 degrees to their 2*180 degrees complement. Note that if the phase curve is not smooth, the computation of unwrapped phase may give a wrong result. Because of this, it is not recommended to select unwrapped phase when displaying the phase of a room measurement. View the phase as wrapped instead.

5.10.6.4.3 Minimum phase

The minimum phase is computed by taking the Hilbert transform of the log magnitude frequency response. If a system is minimum phase this means that for a given frequency response, the input energy will be transferred to the output in the least amount of time.

5.10.6.4.4 Excess phase

The excess phase is the difference between the actual phase and the minimum phase, the phase shift in excess of the minimum phase shift.
For excess phase measurements the phase influence of the microphone can usually be ignored since a microphone usually has a nearly minimum phase response.

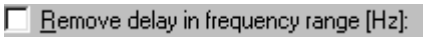
5.10.6.5 Smoothing

If the check box shown below is checked, frequency domain smoothing is performed.

The type of smoothing or integration is set from the 

button and is described in the frequency response/spectrum plot type settings documentation.

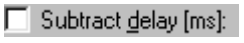
5.10.6.6 Remove delay in frequency range

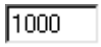
If 

is checked, the delay is removed in the frequency range specified below the check box:

If the settings above are used, the delay is removed in the range 50-10000 Hz. If **Subtract delay** as described below is used together with this option, the delay is first removed in the specified frequency range, then the delay is subtracted.

5.10.6.7 Subtract delay

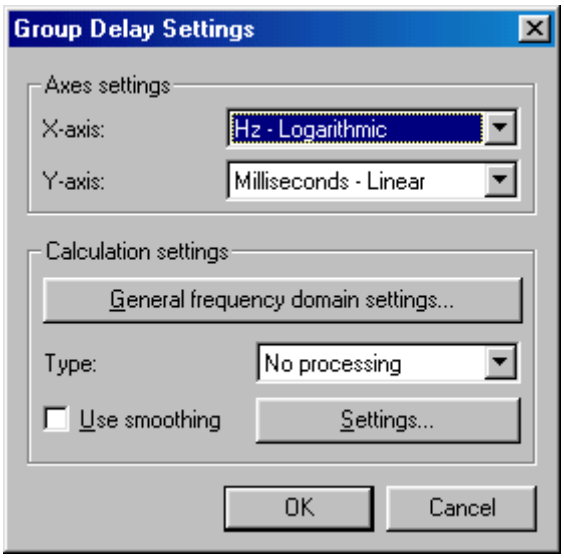
If 

is checked, the specified delay 

is removed. If **Subtract delay** and **Remove delay in frequency range** (described above) is used together, the delay is first removed in the specified frequency range and finally the delay is subtracted.

5.10.7 Group Delay

Displays the dialog box shown below.



Group delay is the derivative of the phase with respect to frequency. The numerical derivation is performed by taking forward differences on left and right edges and taking cantered differences on interior points.

5.10.7.1 X-axis settings

Selects the unit of the x-axis from one of the units displayed in the list shown below.

5.10.7.2 Y-axis settings

Selects the unit of the y-axis and the processing of the data from one of the choices displayed in the list shown below.

If **Milliseconds – Logarithmic** is selected, note that the logarithm of negative group delay values cannot be computed. If negative values exist, they are not plotted.
If several curves are plotted and the y-axis setting is changed, the curves will be updated using the **Plot->Refresh All** procedure.

5.10.7.3 General Frequency Domain Settings

Click the button 

to open the dialog box also accessed from **Plot->General Frequency Domain Settings…**.

5.10.7.4 Type

Selects the type of phase from the list below

5.10.7.4.1 No processing

No processing of the group delay is performed.

5.10.7.4.2 Minimum group delay

The minimum group delay is computed as the derivative of the minimum phase frequency response.

5.10.7.4.3 Excess group delay

The excess group delay can be used to check time alignment in speaker system. It is computed as the derivative of the excess phase frequency response.

5.10.7.5 Smoothing

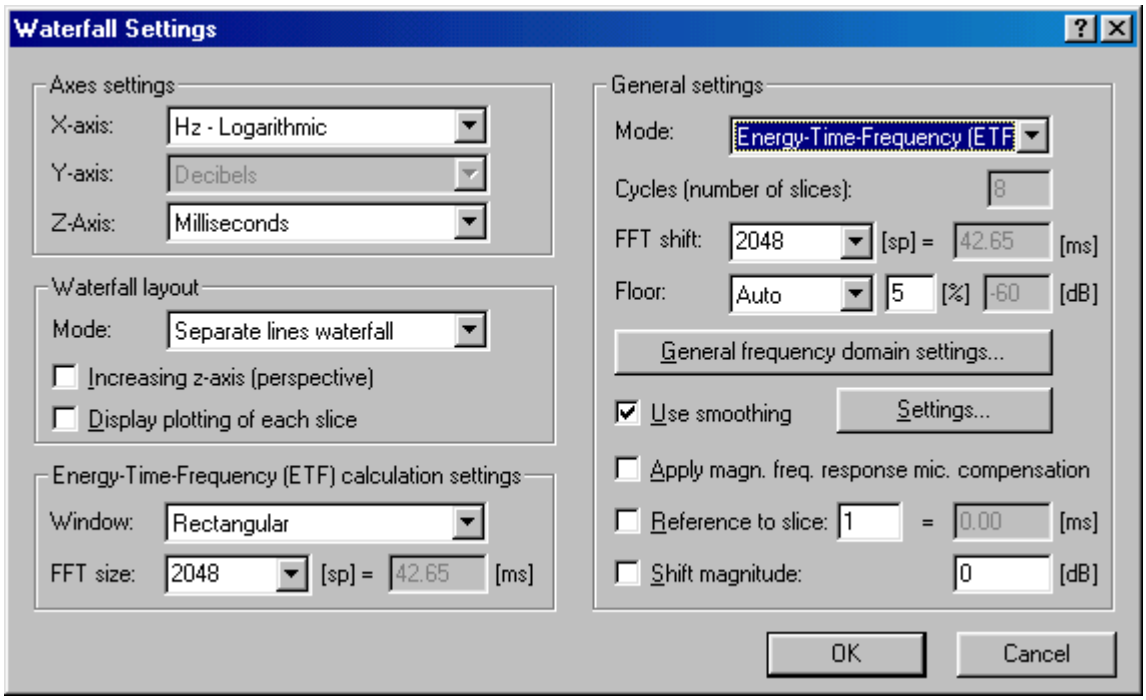
If the check box shown below is checked, frequency domain smoothing is performed.

The type of smoothing or integration is set from the 

button and is described in the frequency response/spectrum plot type settings documentation.

5.10.8 Waterfall

Displays the dialog box shown below.



5.10.8.1 X-axis settings

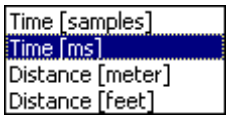
Selects the unit of the x-axis from one of the units displayed in the list shown below.

5.10.8.2 Y-axis settings

Displays the unit of the y-axis. Only **Decibels** is supported.

5.10.8.3 Z-axis settings

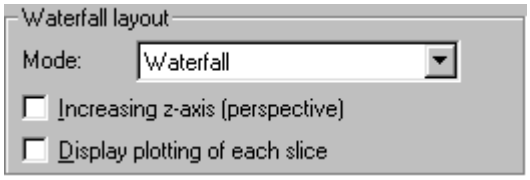
Selects the unit of the z-axis from one of the units displayed in the list shown below.



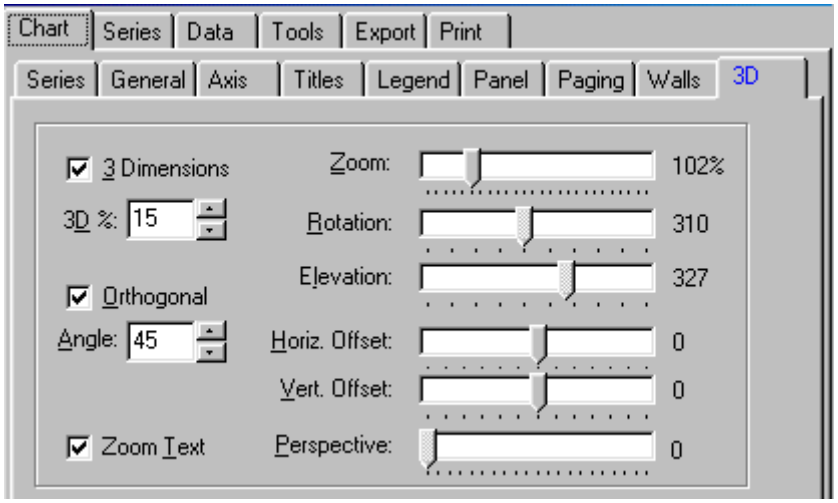
If several curves are plotted and the x-axis setting is changed e.g. from **Time [samples]** to **Time [ms]**, the curves will be updated using the **Plot->Refresh All** procedure.

5.10.8.4 Waterfall layout

Settings for determining some of the waterfall layout properties.



Note that other layout settings such as zooming, rotation, elevation, offset are found in **Plot->Chart Settings for Active Plot...** under the 3D tab as shown below.

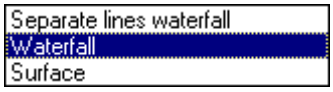


In order to set the **Rotation** and **Elevation**,  must be unchecked.

5.10.8.4.1 Mode

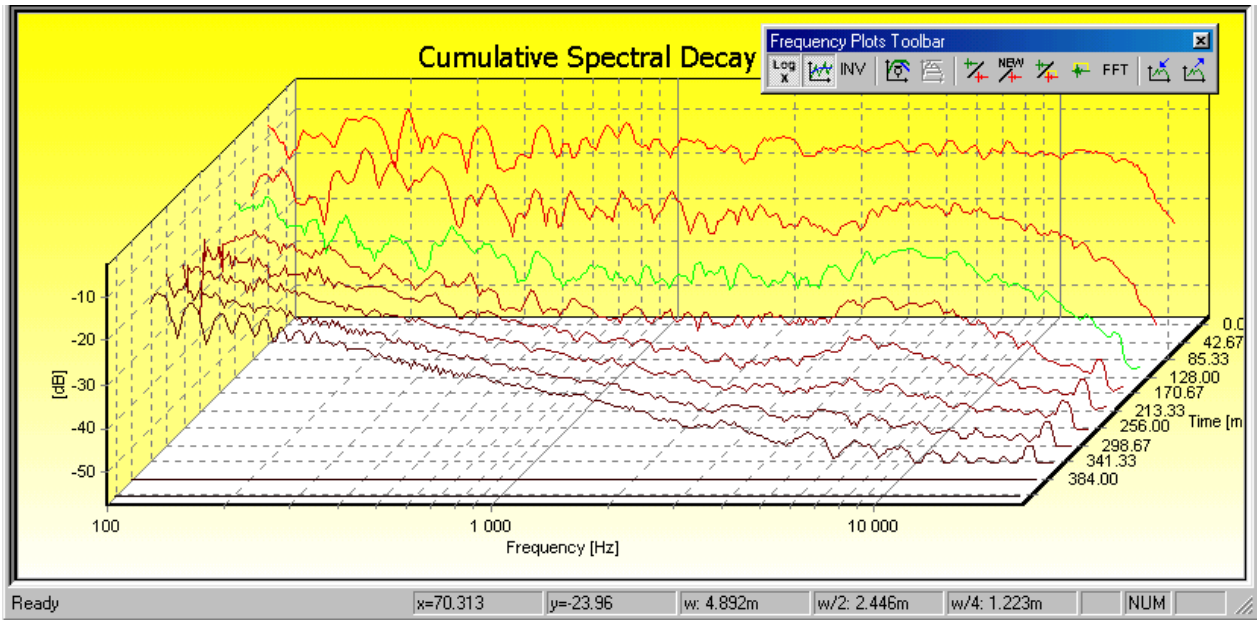
Selects how the waterfall is viewed.

Three choices are possible as shown below.



5.10.8.4.1.1 Separate lines waterfall

The waterfall plotted as separate lines.

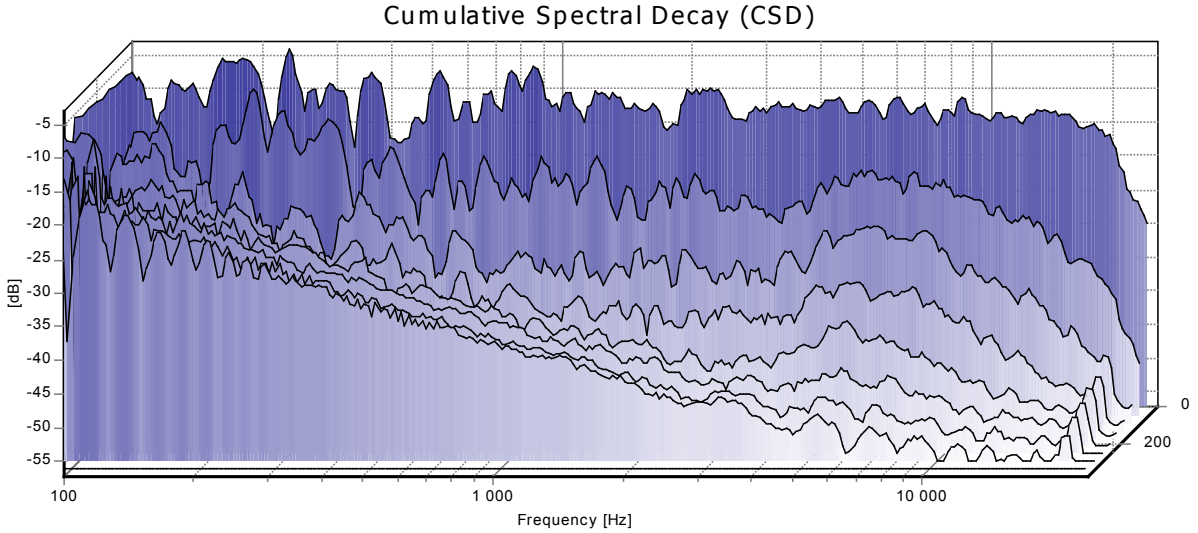


The first advantage of this mode is that slices containing more than 2000 points can be plotted. This is not possible with the other two modes, so if more than 2000 points are tried to be plotted WinMLS automatically switches to this mode.

The second advantage of this mode is that the  and  buttons on the **Frequency Plots toolbar** can be used to set the active slice for reading cursor values on the **Status Bar** (displayed at the bottom of the WinMLS area as shown in the figure above).

5.10.8.4.1.2 Waterfall

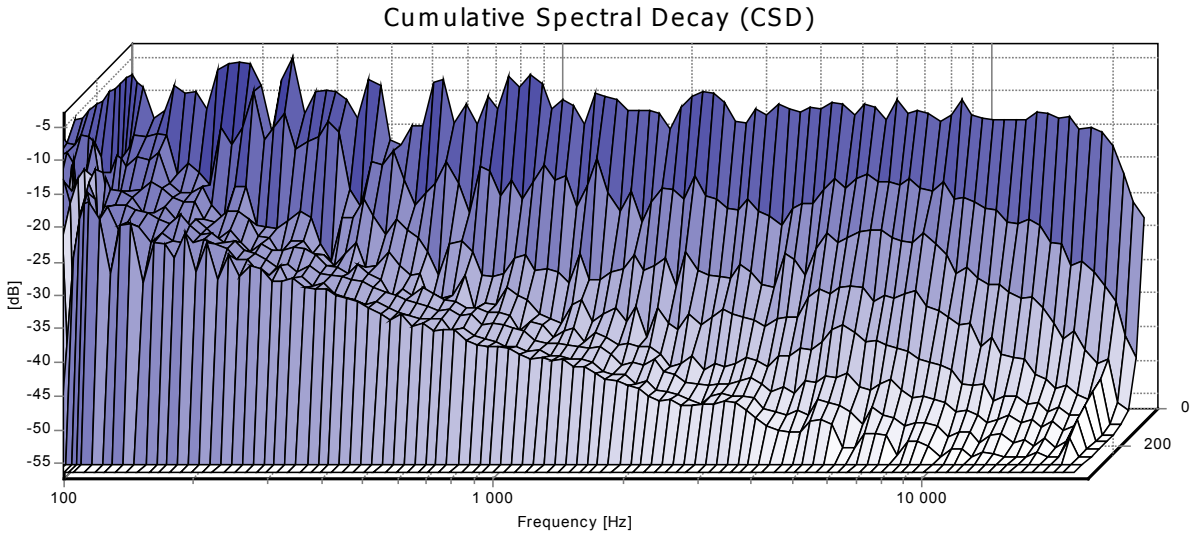
The waterfall is plotted using horizontal slices as shown in the figure below. The figure is made using **File->Copy to Clipboard** with **Plot->White background on Copy/Print** checked.



The mode **waterfall** has a limit of 2000 points in each slice. To get within this limit we recommend using smoothing.

5.10.8.4.1.3 Surface

The waterfall is plotted using lines from all the neighbouring data-points as shown in the figure below. The figure is made using **File->Copy to Clipboard** with **Plot->White background on Copy/Print** checked.



The mode **surface** has a limit of 2000 points in each slice. To get within this limit we recommend using smoothing.

5.10.8.4.2 Perspective

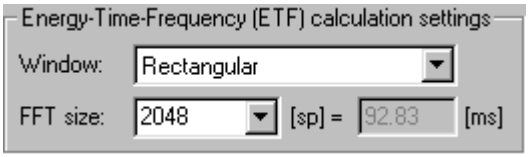
If ☐ Increasing z-axis (perspective) is checked, the backside of the waterfall plot is displayed.

5.10.8.4.3 Display plotting of each slice

If ☐ Display plotting of each slice is checked, each slice will be plotted right after it has been computed. Note that if it is checked, the plotting will take more time since if it is unchecked, all slices will be computed and then plotted in one operation.

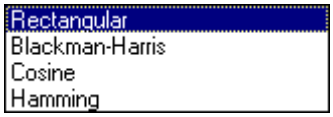
5.10.8.5 Energy-Time-Frequency (ETF) calculation settings

Determines the special settings for the Energy-Time-Frequency mode. The special settings determine size of the data used for computing each slice (**FFT size**) and the window type applied on each of the slices. Note that no zero-padding is applied in computing Energy-Time-Frequency mode. The DC-component, if any, is not removed from each slice.



5.10.8.5.1 Window type

Select the window type to be used for computing each of the slices. The choices are displayed below.



5.10.8.5.2 FFT size

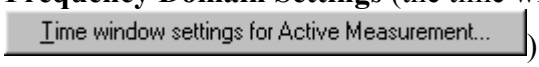
Select the length of the data to be used for computing each of the slices using the Fourier transform. The number must be specified in samples, it can be typed or chosen from the list. The resulting length in milliseconds is also displayed.

5.10.8.6 Mode

Sets what type of waterfall plot is to be displayed.

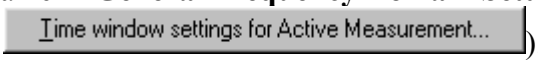
The choices are displayed and explained below.

5.10.8.6.1 Energy-Time-Frequency (ETC)

The Energy-Time-Frequency mode is the same as a spectrogram. The data used for computing the waterfall is the windowed measurement data. The time window on the data in **General Frequency Domain Settings** (the time window is found clicking the button 

) determines the part of the time data the ETF is calculated from. It also determines if the time data is to be windowed before computing the ETF. The windowed measurement data are divided into slices and the Fourier transform is computed for each slice. Special settings for this mode are found in the bottom right of this dialog box under **Energy-Time-Frequency (ETF) calculation settings**. The special settings determine the size of the data used for computing each slice (**FFT size**) and the window type applied on each of the slices. Note that no zero-padding is applied in computing Energy-Time-Frequency mode. The DC-component, if any, is not removed from each slice.

5.10.8.6.2 Cumulative Spectral Decay (CSD)

This mode is generated by computing the FFT of successively left-shifted versions of the windowed measurement data. The first slice is exactly the same as plotting the magnitude frequency response (**Frequency Response/Spectrum** plot type). This is because the FFT size and time window on the data is the same in **General Frequency Domain Settings** (the time window is found clicking the button 

). The next slices are computed by shifting this window (successive slices are shifted). The size of the shift is specified in **FFT Shift**. The number of slices is determined by **Cycles (number of slices)**. The computation does not stop if the end of the measurement is reached. The DC-component is

removed from each slice. This is done by subtracting the DC-component of the last half of each slice.

5.10.8.7 Cycles

Determines the number of slices to be displayed.

If Cumulative Spectral Decay (CSD) is selected as waterfall mode, the number of slices to be plotted is set here.
If Energy-Time-Frequency (ETC) is selected as waterfall mode, the number of slices to be displayed is set by the time data window (the button 

in **General Frequency Domain Settings**). However, the number of slices is displayed, but is disabled.

5.10.8.8 FFT shift

Sets how many samples the slices are to be shifted before computing the magnitude frequency response on the measurement data. The number is also displayed in milliseconds as shown below.

5.10.8.9 Floor

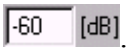
Determines if a floor is to be used and where to set the floor. The purpose of the floor is to make the waterfall plot look nicer. The waterfall data having values lower than the floor limit, e.g. –60 dB will be given this value. The floor is thus not the same as the y-axis minimum value.

Three choices are available as shown below.

5.10.8.9.1 No floor

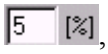
The waterfall is displayed without any floor.

5.10.8.9.2 Use floor:

Floor is used and the floor limit is determined using the dB setting 

.

5.10.8.9.3 Auto

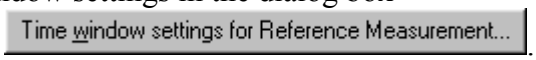
Floor is used and the floor limit is determined automatically so that a percentage of the last part (20 percent) of the measurement data, given by 

, will be a part of the floor.

5.10.8.10 General Frequency Domain Settings

Click the button 

to open the dialog box also accessed from **Plot->General Frequency Domain Settings…**.
Note that the settings that do not apply to the waterfall plot type are disabled.
If complex division using the reference measurement is selected in **Plot->General Frequency Domain Settings…**, the resulting complex frequency response is inverse Fourier thus performing deconvolution. The deconvolved measurement is used for the waterfall computation. The window limits for the deconvolution are set by the window settings in the dialog box


and 

. But if Cumulative Spectral Decay is chosen as mode, the end window limit for the active measurement is set as the end of the measurement.

5.10.8.11 Smoothing

If the check box shown below is checked, frequency domain smoothing is performed on each slice.

The type of smoothing or integration is set from the 

button and is described in the **Frequency response/Spectrum** plot type settings documentation.

5.10.8.12 Microphone correction

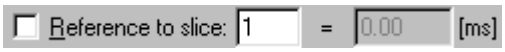
If 

is checked, the microphone compensation specified in the Frequency response/Spectrum settings (**Plot->Plot Type Settings->Frequency Response/Spectrum…**) is used for the waterfall plot also.
Note that each frame is compensated for the microphone magnitude response.

5.10.8.13 Reference

If 

is checked, the selected slice (in the figure below slice number 1) is used as reference. All slices will be viewed as differences to the reference slice. The reference slice will therefore be flat.



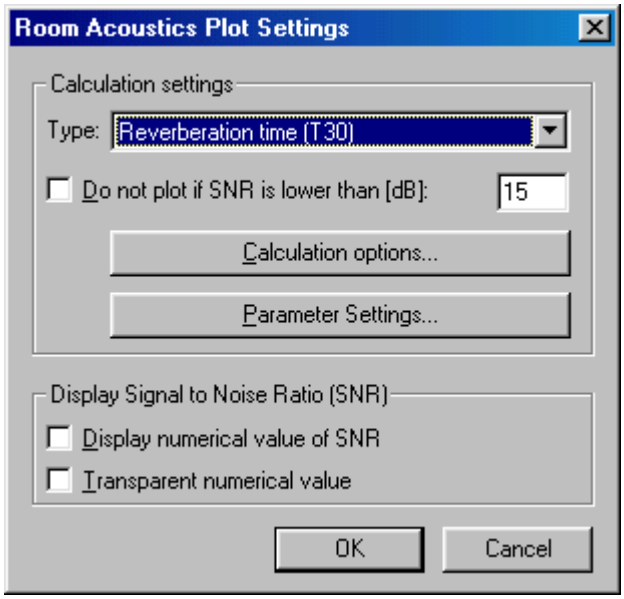
5.10.8.14 Shift magnitude

If 

is checked, the magnitude is shifted in dB given by 

5.10.9 Room Ac. Parameters...

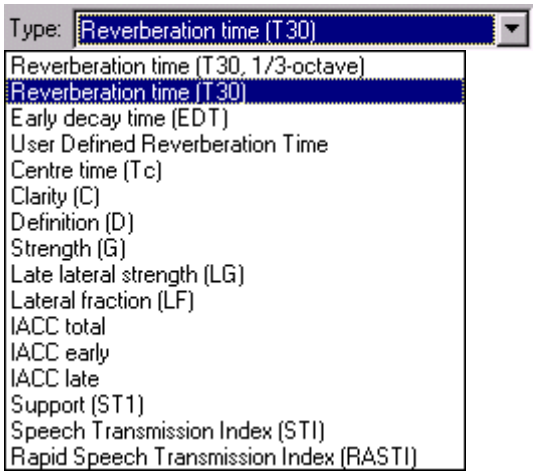
Displays the dialog box shown below.



Room acoustics parameters, such as reverberation time and speech transmission index can be displayed.

5.10.9.1 Type

The types of acoustical parameters that may be computed and displayed are shown below.



The parameters are explained in the Room Acoustics Users Guide.

5.10.9.2 Plotting dependency on SNR

If the check box shown below is checked, values of parameters that have a worse signal-to-noise ratio than the number specified below will not be displayed.

5.10.9.3 Calculation Options

Clicking 

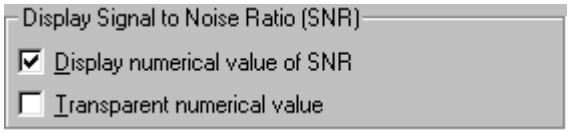
opens the same dialog box as **Room Acoustics->Calculation Options…**. An explanation of the dialog box is given in the Room Acoustics Users Guide.

5.10.9.4 Parameter Settings

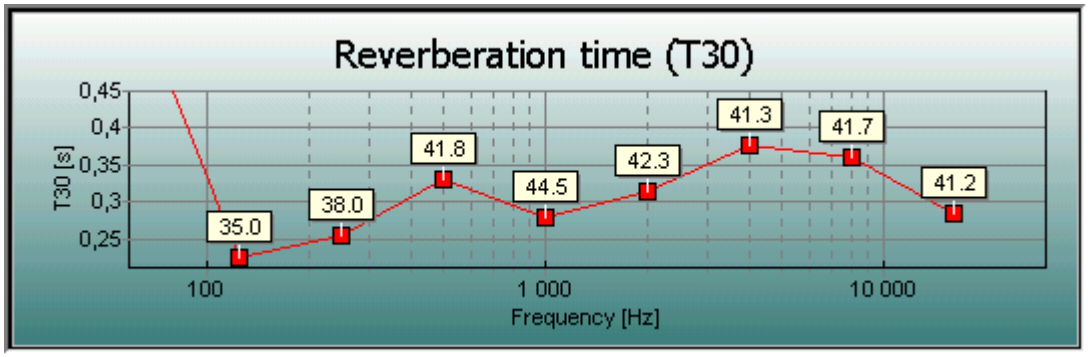
Clicking 

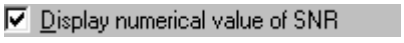
opens the same dialog box as **Room Acoustics->Parameter Settings…**. An explanation of the dialog box is given in the Room Acoustics Users Guide. The settings in the dialog box that are not used for the plot type are disabled.

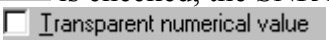
5.10.9.5 Display Signal to Noise Ratio (SNR)



The signal-to-noise ratio can be displayed in the plot as numbers in the plots as shown in the figure below.



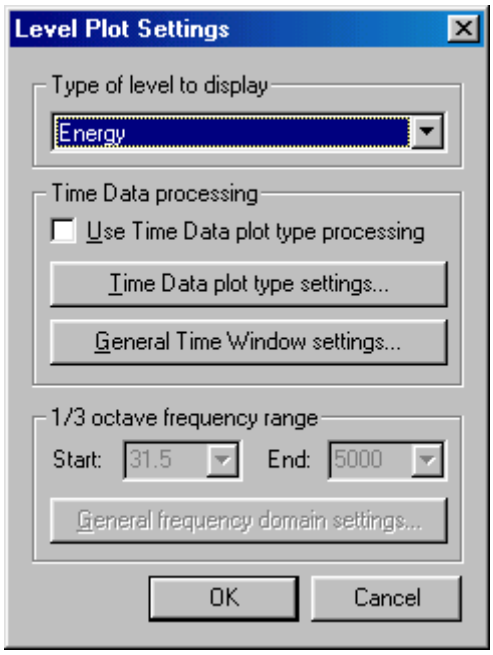
If 

is checked, the SNR is added as marks above the plot points as shown in the figure below. If 

is checked, the mark is transparent and not yellow.

5.10.10 Levels

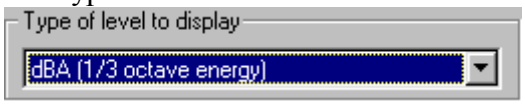
Displays the dialog box shown below.



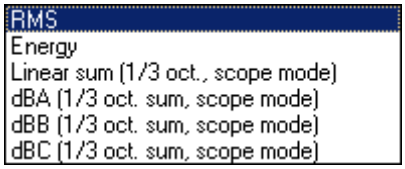
Note that this plot type may not be automatically refreshed for all kinds of changes in settings.

5.10.10.1 Type of level

The type of level is selected as shown below.



The choices are displayed below.



Note that in order to give for example the RMS of the sound card input signal, the input must be calibrated (**Measurement->Hardware Calibration)** and the measurement must not be in transfer function mode (e.g. a MLS measurement will consider the output at well).

5.10.10.1.1 RMS

The RMS value of the windowed measurement data is computed and displayed. The window settings are found in Time Data processing described below.

5.10.10.1.2 Energy

The RMS value of the windowed measurement data is computed and displayed. The window settings are found in Time Data processing described below.

5.10.10.1.3 Linear sum (1/3 oct., scope mode)

The linear sum of 1/3-octave frequency bands is computed and displayed. The frequency range is determined in the *1/3 octave frequency rang* settings.

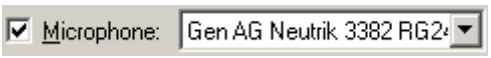
If the measured data is a transfer function (for example measured with MLS output signal), the data are corrected for the output signal so that the value for the input only is computed. This makes it possible to plot the input level and is why it is called **scope mode**. Two types of scope mode is supported, either **Stationary signal (power)** or **Transient signal (energy)**. The scope mode settings are found in the lower right of the dialog box displayed after clicking 

as shown in the figure below.

If you are measuring impulse responses, **Transient signal (energy)** should be selected.

Note that the correct absolute value is given only if the absolute level of the input is calibrated. In **Measurement->Hardware Calibration....**, click the **Settings...** button as shown below.

Note also that if **Microphone compensation** is turned on in **Plot->Plot Type Settings->Frequency Response/Spectrum...** as shown below,



then microphone compensation will also be used in when computing the frequency response for the **Levels** plot type.

5.10.10.1.4 dBA

The dBA-weighed sum of 1/3 octave frequency bands is computed and displayed. The computation is done as explained in the chapter above *Linear sum (1/3 oct., scope mode).*

5.10.10.1.5 dBB

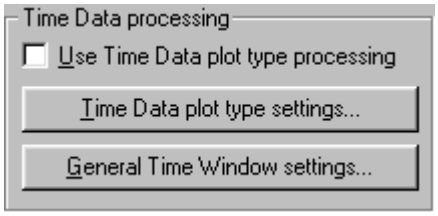
The dBB-weighed sum of 1/3 octave frequency bands is computed and displayed. The computation is done as explained in the chapter above *Linear sum (1/3 oct., scope mode).*

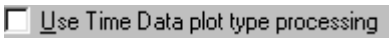
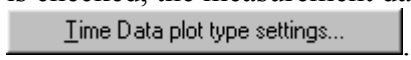
5.10.10.1.6 dBC

The dBC-weighed sum of 1/3 octave frequency bands is computed and displayed. The computation is done as explained in the chapter above *Linear sum (1/3 oct., scope mode).*

5.10.10.2 Time Data processing

Determines how the measurement data is processed before computing **RMS** or **Energy**.

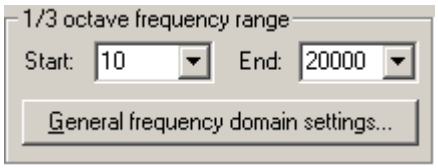


If  is checked, the measurement data will be processed according to the settings obtained by clicking  . These settings are described under **Plot->Plot Type Settings->Time Data…**.

Clicking  gives access to the time window settings determining what part of the measurement data to be used for the computation and the window applied to the measurement data.

5.10.10.3 1/3 octave frequency range

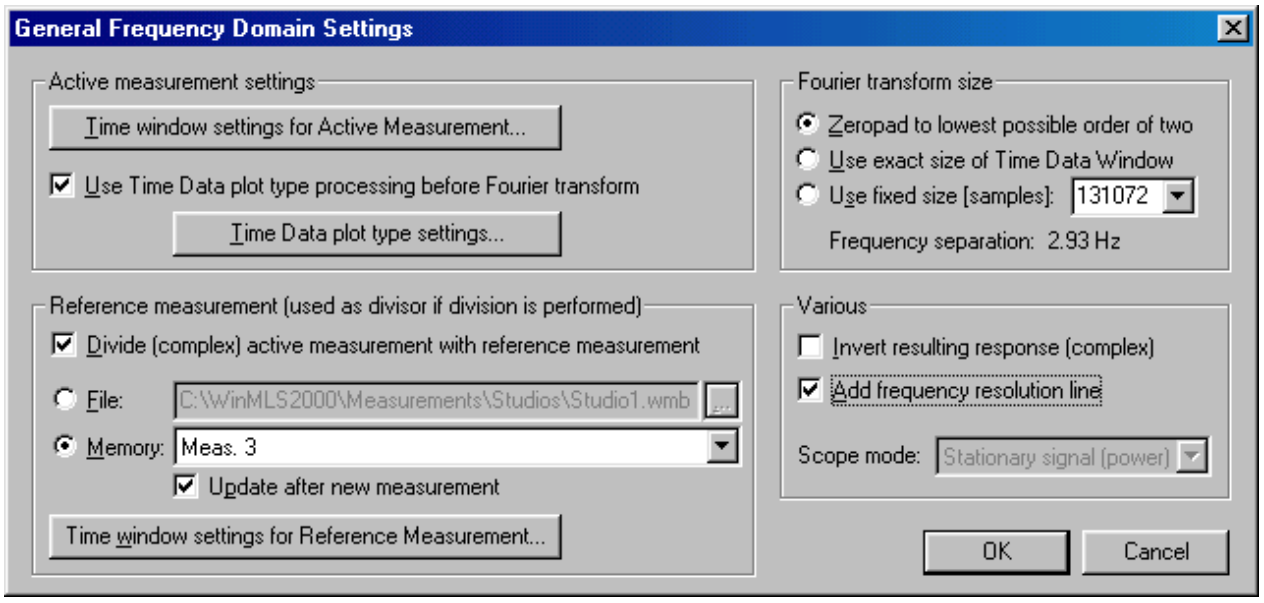
Determines the frequency range used for computing the **Linear sum, dBA, dBB** and **dBC**.



Clicking  gives access to the settings for computing the octave bands. The frequency response data are integrated to obtain the energy in each band.

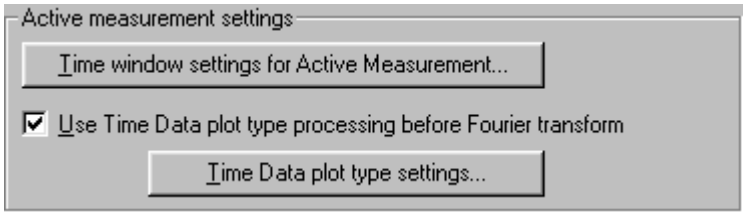
5.11 General Frequency Domain Settings...

Displays the dialog box shown below containing settings that apply to all frequency domain plot types.



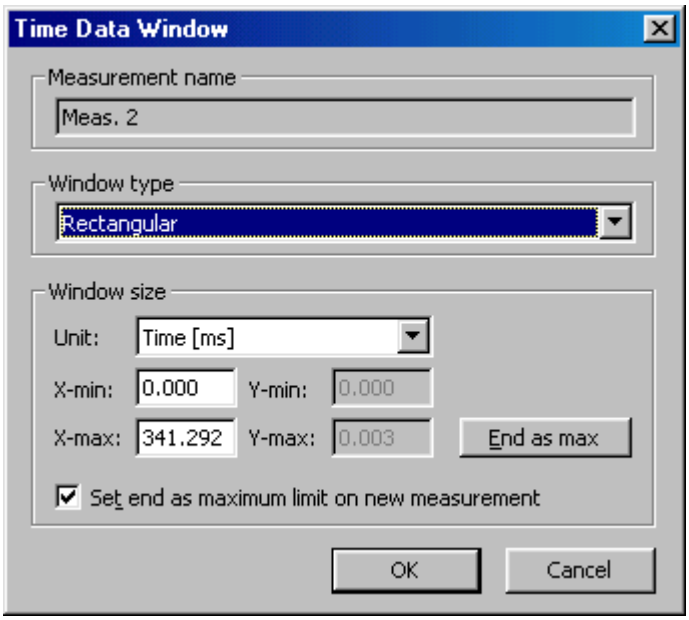
5.11.1 Active measurement settings

Settings for the active measurement in the upper plot, and the active measurement in the lower plot, if there are two plots. However, if **Plot->Refresh All** is selected, all the most recent curves for each measurement will be refreshed using the current settings.



5.11.1.1 Time window settings for Active Measurement... Time window settings

Clicking this button opens the dialog box displayed below for setting the window size and type.



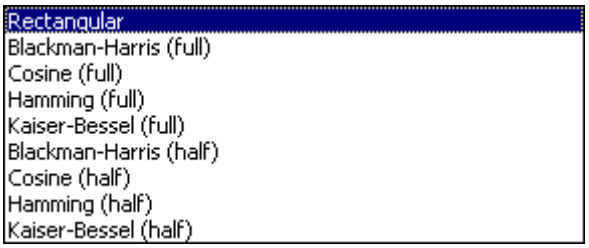
5.11.1.1.1 Measurement name

Displays the measurement the window is applied to.

5.11.1.1.2 Window type

Selects the type of window to be used.

The possible choices are shown in the figure below. Note that if an impulse response is to be windowed, it is not recommended to use a *full* window.

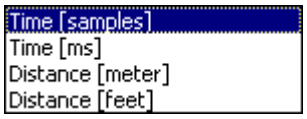


5.11.1.1.3 Window size

Sets the start and end of the window. The corresponding y-values are also shown.

The unit 

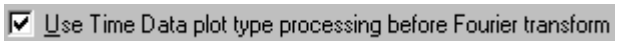
determines the units of the window limits to be displayed in the dialog box. The following may be selected:



The button 

is used to set the end of the measurement to the end window limit.
If 

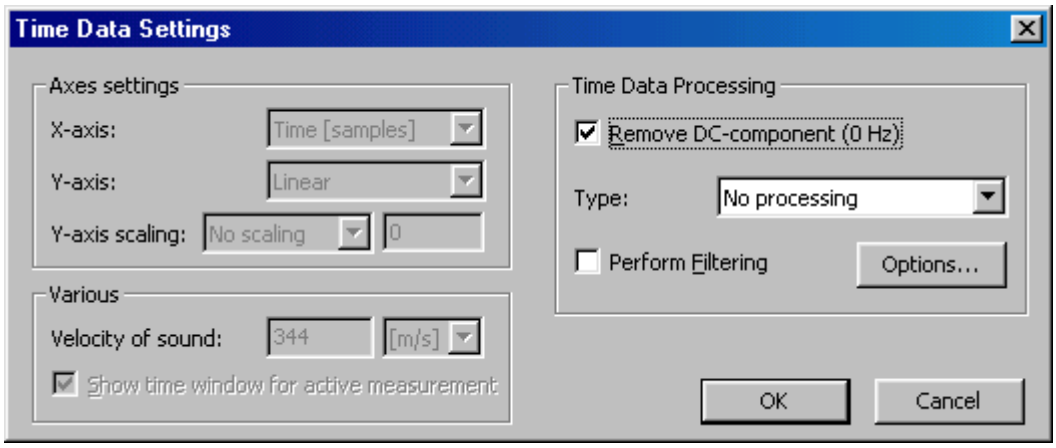
is checked, the X-max is set to the maximum value possible when a new measurement is performed or inserted.

5.11.1.2 

Determines if the processing of the Time Data plot type is to be applied before computing the frequency response. Note that if this is not checked, the DC-component is automatically removed.

5.11.1.3 

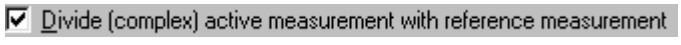
Opens the settings for the Time Data plot type shown below.



Only the **Time Data Processing** settings are enabled since the other settings have no effect in the frequency domain. This dialog box is explained in the **Time Data Settings** documentation.

5.11.2 Reference measurement

Contains the settings for the reference measurement.

5.11.2.1  Perform division

If checked, the active measurement is divided complex with the reference measurement. If the sampling frequency is not the same for the active and the reference measurement, no division is performed and an error message is displayed.
The zero-padding size has to be the same for the two measurements or else the division will not work, also the zero-padding size must be larger than the window size for both measurements to

prevent truncation. Therefore the longest Time Data Window of the two measurements is used as basis of finding the zero-pad size.

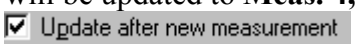
5.11.2.2 Select reference measurement

The reference measurement can be selected either from file or from the measurements available in memory.

If you want to select the measurement from *file*, first check 

, then click the  button to open the browser. Note that the selected file is not added to the memory measurement file list.
If the measurement is selected from memory as shown in the figure above, it is possible to update the reference measurement when a new measurement is performed by checking 

. Then if a new measurement is performed or inserted, the reference measurement is set to the current active measurement, for example if the active measurement is **Meas. 3** and a 1-channel measurement is performed. The new active measurement will get the name **Meas. 4**, while the reference measurement will be updated to **Meas. 3**, since **Meas. 3** was the active measurement before the measurement was performed. This feature is useful if you want to monitor the difference between the current and the previous measurement. For example if. 3 measurements are inserted in one operation (using **File->Insert**), the reference measurement will be updated 3 times. When the first measurement is plotted the current active measurement will be used as reference measurement- When the second measurement is plotted, the first measurement will be used as reference measurement. When the third measurement is plotted, the second measurement will be used as reference measurement. This is useful to monitor the difference between the measurements taken after one another.
If a multi-channel measurement is performed and 

is checked, channel 2 of the performed or inserted measurement will be set as the reference measurement. E.g. if a 2-channel measurement is performed and has the name **Meas. 4**, **ch. 1**, the reference measurement will be updated to **Meas. 4, ch 2**. If two or more measurements are inserted and 

is checked
This feature is useful if you want to monitor the difference between the two channels.

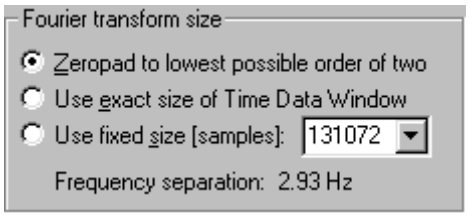
5.11.2.3 

Clicking this button opens the dialog box for setting the window size and type for the reference measurement. This dialog box is similar to the button for setting the time window for the active measurement 

, and refer to this to get more information.

5.11.3 Fourier transform size

Selects the size of the Fourier transform for the active measurement and for the reference measurement if division is to be performed. The choices shown in the figure below will be discussed.



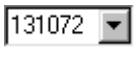
5.11.3.1 Zeropad to lowest possible order of two

This is the setting that gives the greatest speed since the Fourier transform is executed fastest when the length of the data is *order of two*, e.g. 1024 which is 2^10. If the windowed data does not have a *order of two* length, the data must be padded. E.g. if the length of the windowed data is 700 samples, the data are padded to obtain the length 1024. Usually zeros are used for this padding, therefore the name *Zeropadding*, but WinMLS does not pad zeros, instead it pads the last value of the windowed data. This is done to prevent from errors in case the data has a DC-component. Note that because this method is applied, this setting should not be used with a **Rectangular** window on non-transient data (this is not recommended anyway).

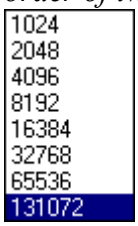
5.11.3.2 Use exact size of Time Data Window

Used to get a Fourier size equal to the exact size of the time data window.

5.11.3.3 Use fixed size [samples]: 131072

Used to determine the exact size of the Fourier transform. Any number may be typed in the 

box. But the numbers on the list gives the best computational speed since they are an *order of two*.



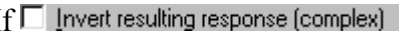
An error message is given if the selected Fourier transform size is less than the size of the time data window and reference measurement time data window if division is to be performed.

5.11.3.4 Frequency separation: 2.93 Hz

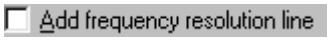
Gives the frequency separation in Hertz, which is the distance between each point along the frequency axis. The frequency separation is equal to the Fourier transform size divided by the sampling frequency.

5.11.4 Various

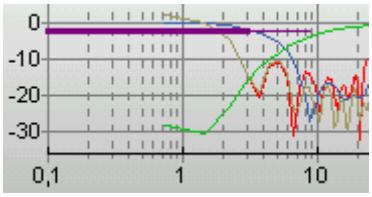
Contains frequency domain various settings.

If 

is checked, the complex frequency response (after division, if division is selected) is inverted.

If 

is checked, a vertical line is added to the frequency domain plot types as shown in the figure below.



The “Frequency resolution line” will indicate graphically where the data should not be trusted. At the thick part of the line, the results should not at all be trusted. At the thin part of the line (which is twice the size of the thick line), the result is not certain.

The color of the line is set in **Plot->Default Curve Styles…**. The line refers to the active measurement curve.

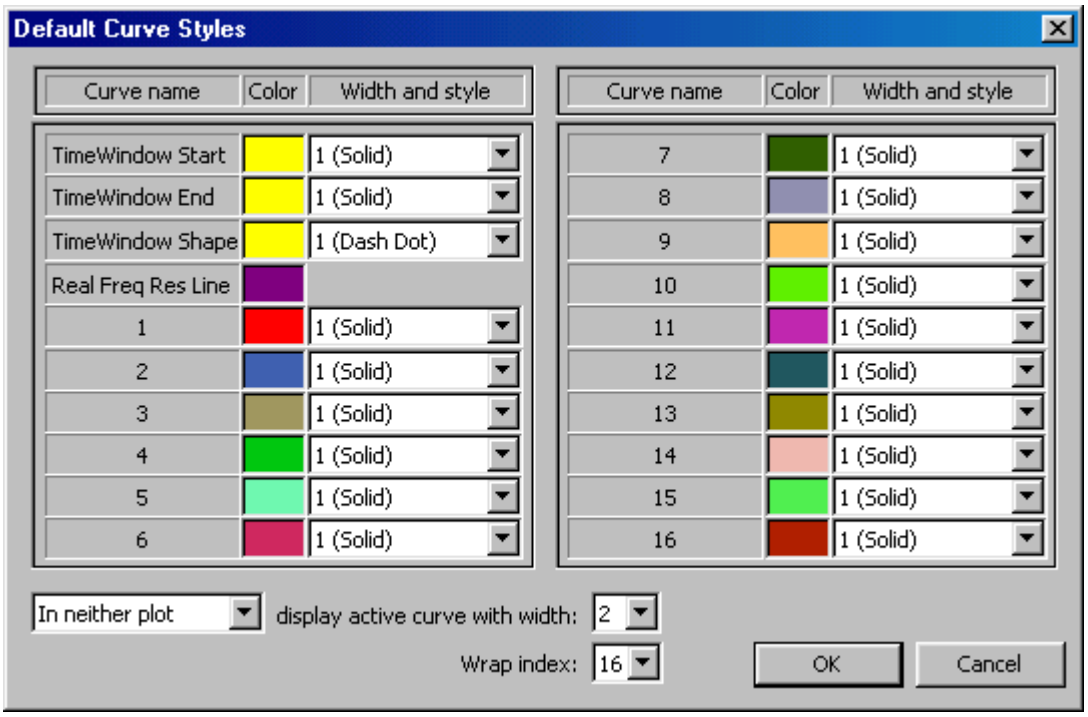
The scope mode setting 

has no effect if the measurement is a transfer function (a MLS measurement). If the measurement is performed in scope mode, the choices shown in the figure below are available.

The settings will affect the scaling of the frequency response. If **Stationary signal (power)** is selected and the plot type is **Frequency Response/Spectrum**, the power will be plotted. If the signal is a transient signal, this should not be selected since the level will depend on the window and zero-padding length. To prevent this, select **Transient signal (energy)**.

5.12 Default Curve Styles

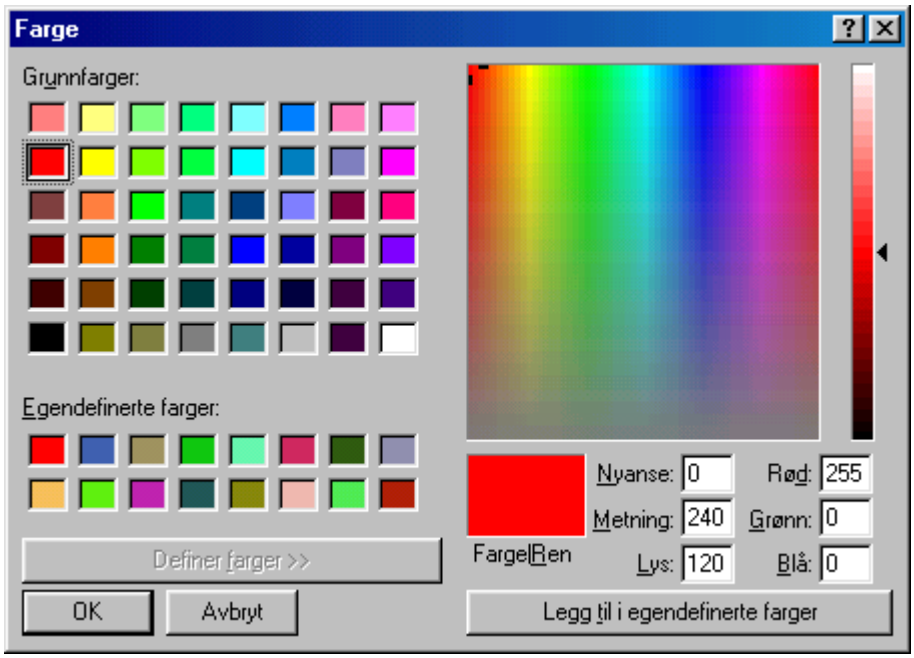
Displays the dialog box shown below.



In the upper left of the dialog box shown above, the styles for the time data window and the frequency resolution line is set. After that the styles for curve 1-16 is set. Curve 1 is the first curve plotted, and from the figure above we see that this has a red color. The next has a blue color and so on.

5.12.1 Selecting curve color

The color is selected by clicking on the color field  . This will open the dialog box displayed below. (The language of the dialog box will set to the language of your operative system, this is why the text in the figure below is not in English).

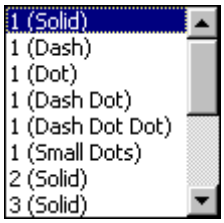


Any color may now be selected by clicking somewhere in the field to the upper right of the dialog box displayed above. The color may also be selected by clicking in any of the fields.

5.12.2 Selecting curve width and style

The curve width and style is set from 1 (Solid).

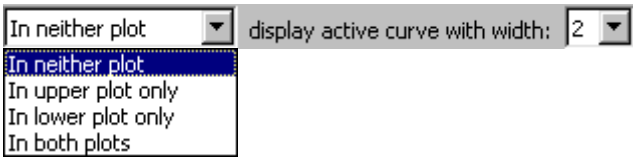
The choices are listed below.



If the curve width is 1, which is the smallest possible, it is possible to plot the line with dashes and/or dots. Note that if the curve contains many data points, the dashes and dots may get so close in the plot that the line looks like it is **Solid**. But if the plot is saved in a picture format, this should not be the case.
Note that if a curve width greater than 1 is selected, the plotting speed is much decreased.

5.12.3 Display curve belonging to active measurement with different width

The curve (most recent) belonging to the active measurement may be displayed with a width different from the other curves as shown below. If curves from several measurements are plotted, this is useful for finding the curve belonging to the active measurement.



If **In neither plot** is selected, this option is turned off. This is recommended, since if a curve width greater than 1 is used, the plotting speed is decreased. We recommend using **Plot->Solo Active Measurement Curve** instead.

5.12.4 Wrap index

This is useful if several curves are plotted and you want the colors to repeat.

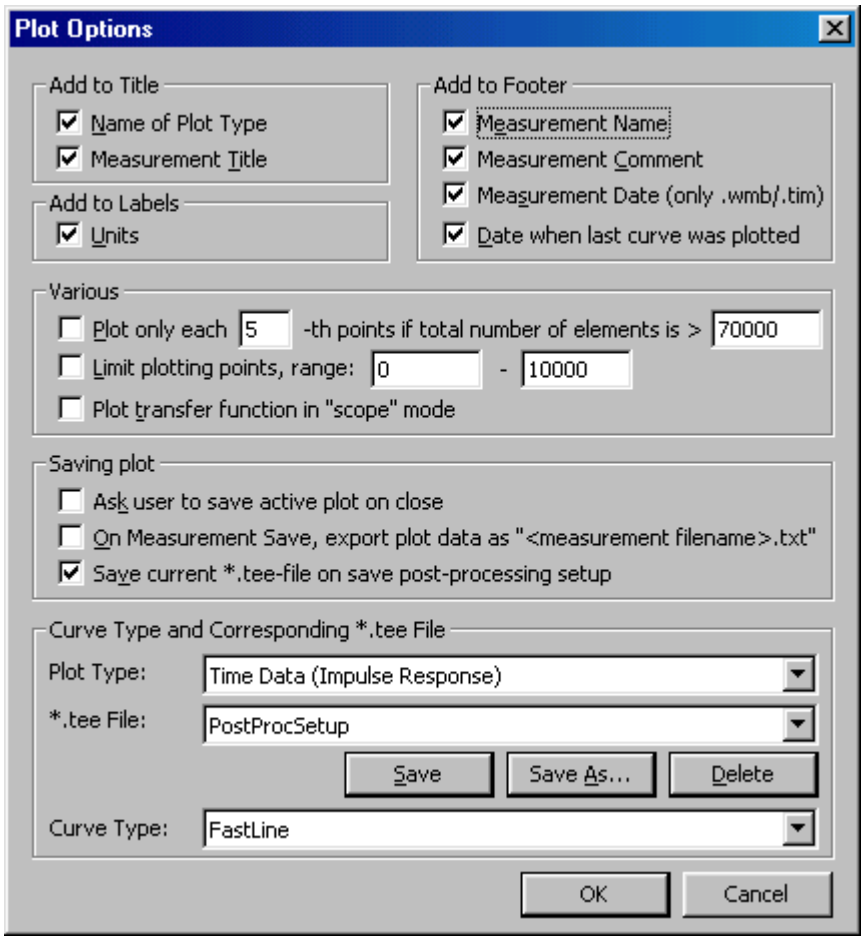
If the wrap index is e.g. set to 4 and 8 curves are plotted, the first 4 curves will get colors as selected from the **Default Curve Styles** list. But the 5th curve will get the same color as the first curve, the 6th curve will get the same color as the second curve, and so on.

5.13 White background on copy/print

If this is checked, when copying or printing the background is set to white. This may be useful for saving ink.

5.14 Advanced Plot Settings…

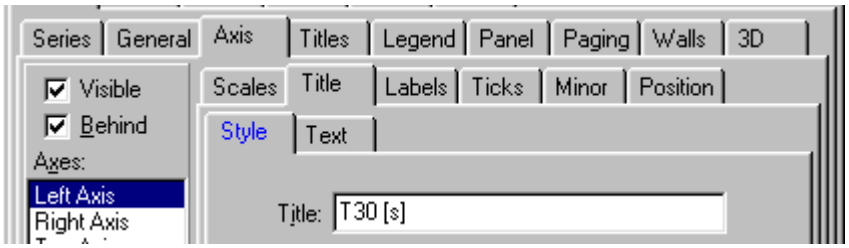
Displays the dialog box shown below.

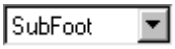


5.14.1 Add text to Plot

These settings determine if the plot title/footer/labels are to be updated and what is written after a measurement is plotted.

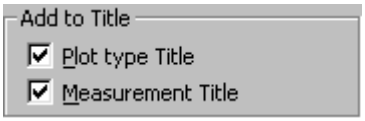
If no check boxes are checked, the text is not changed. This is useful if you want to use your own text. The axis labels is set in **Plot->Chart Settings for Active Plot...** under the **Axis** tab, then under the **Titles** tab as shown in the figure below.

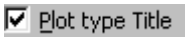


The title is set in **Plot->Chart Settings for Active Plot...** under the **Titles** tab. The footer is also set there by selecting 

as shown below.

5.14.1.1 Add to Title



If 

is checked, the title of the plot type is added to the plot title. The title added is normally the name of the plot type. E.g. the plot type **Time Data** gets "Time Data" as title. But the title may in some cases depend on the plot type settings. E.g. if the plot type is **Room ac. Parameters** and **Reverberation Time (T30)** is selected as parameter type, the title is "Reverberation Time (T30)".

If 

is checked, the title of the measurement that is plotted is added to the plot title. Note that if the measurement is a .wmt-file or .wav-file not generated using WinMLS 2000, the measurement header will not contain any title.

In order to actually view the title in the plot, the button  on the **Standard Toolbar** must be toggled.

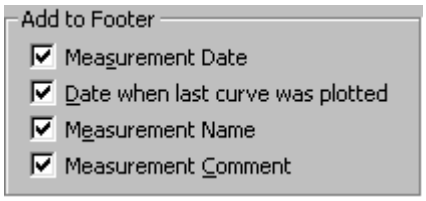
5.14.1.2 Add to Axis Titles

If 

is checked, axes units will be added according to the plot type settings and the plotted measurement data header.

In order to actually view the title in the plot, the button  on the **Standard Toolbar** must be toggled.

5.14.1.3 Add to Footer



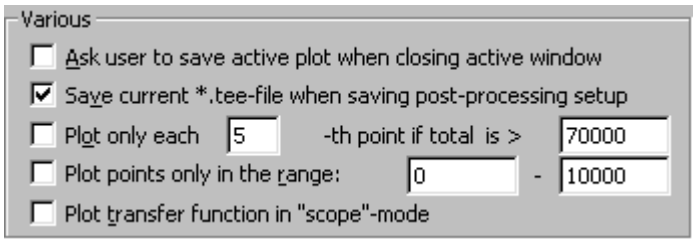
If Measurement Date is checked, the date of the plotted measurement is added.

If Measurement Name is checked, the name of the plotted measurement is added.
If Measurement Comment is checked, the comment of the plotted measurement is added.
If Date when last curve was plotted is checked, the date when the last curve was plotted is added.

Note that if the measurement is a .wmt-file or .wav-file not generated using WinMLS 2000, the measurement header will not contain any measurement *date* or *comment*.

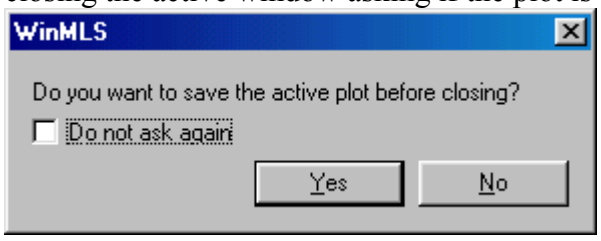
In order to actually view the title in the plot, the button on the **Standard Toolbar** must be toggled.

5.14.2 Various



These settings apply to all plot types.

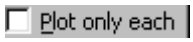
If Ask user to save active plot when closing active window is checked, a message box is displayed when closing the active window asking if the plot is to be saved.



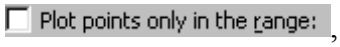
If **Yes** is chosen, the browser for saving the active plot as picture format is displayed (same as **File->Save Active Plot As…**).

If 

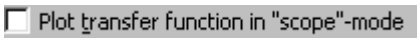
is checked, the chart-file is saved when the post-processing setup is saved. Also when the temporary post-processing setup is saved, a temporary Chart-file is saved. A Chart-file contains all the settings in the **Plot->Chart Settings for Active Plot...** dialog box except for the settings of the plotted curves.
Note that when it is unchecked, the curves in the plot are not deleted automatically. This means that when a new **Group** window is opened or when the software is run, the previous curves are not deleted.

By checking 

only every n^{th} point will be plotted if the total length of the data is below as certain limit. This may be useful to make the plotting faster if a large file is to be plotted, e.g. a large .wav-file.

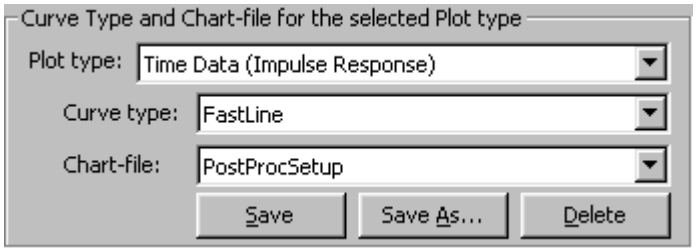
By checking 

, it is possible to plot just a certain range of the data points. This may be useful for plotting a part of a large file.

If 

is checked, a transfer function measurement (a MLS measurement) is plotted in scope mode. This means that only the scaling of the input is considered, and not the output scaling.

5.14.3 Curve Type and corresponding Chart-file



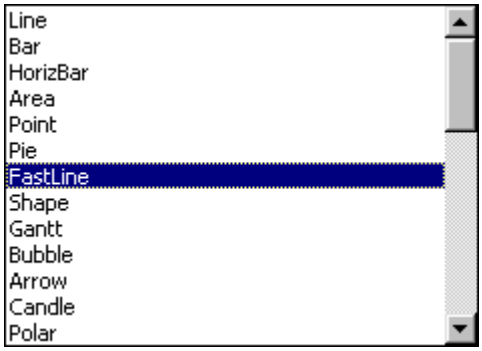
5.14.3.1 Plot type

The **Curve type** and **Chart-file** that corresponds to the selected **Plot type** is displayed. The user may select a new **Curve type** and **Chart-file** for the specific plot type. All the available plot types are present in the list.

5.14.3.2 Curve type

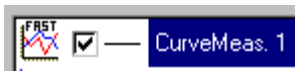
In the post-processing setups found when installing WinMLS, the default curve type for most plot types is set to **FastLine** as shown in the figure below.

This means that the curves are drawn using the **FastLine** type. Please note that for the **Room Ac. Parameters** plot type, single-valued parameters are plotted with the plot type **Bar** independent of the curve type chosen here.
Some of the available curve types are shown in the figure below.

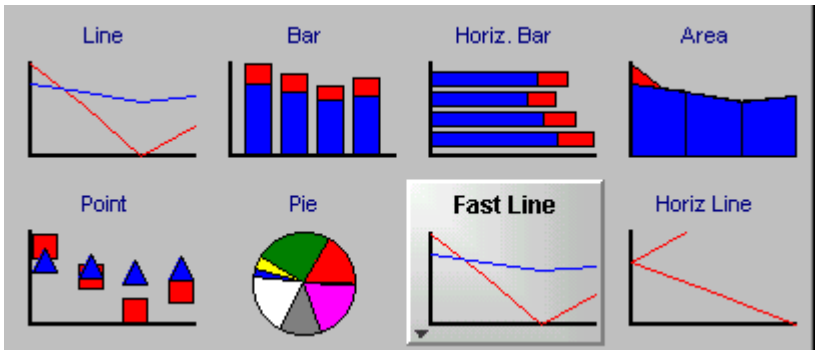


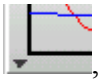
Note that not all the curve types from the list will make sense for all plot types. Some useful items are: **Line** (it has more features than **FastLine** and is used for the **RoomAc Parameters** plot type), **Bar**, **Area**, **Point**, **FastLine**, **Histogram** (useful e.g. for plotting octave bands).

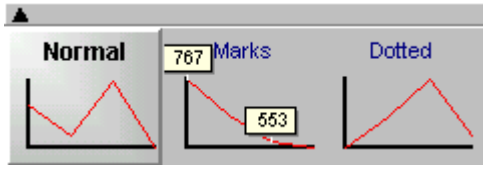
Examples on how the curve types look like are found in **Plot->Plot Layout…**. From this dialog box the curve type in the current plot can be set.



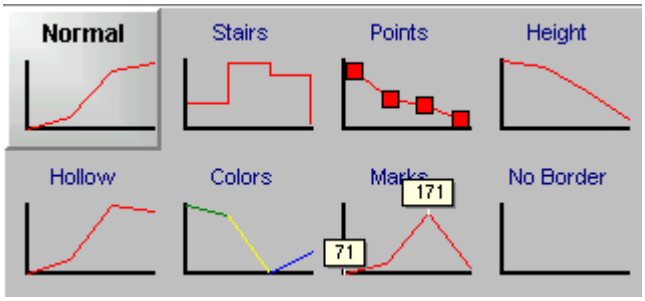
In the dialog box obtained from **Plot->Plot Layout…**, click on  shown in the figure above. A new dialog box will be displayed showing curve types to select from, some of which are shown in the figure below.



By clicking on the small arrow in the lower left corner of Fast Line  , the possibilities for this line type is displayed as shown in the figure below.

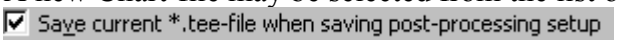


For the curve type **Line**, the following choices are possible.



5.14.3.3 Chart-file

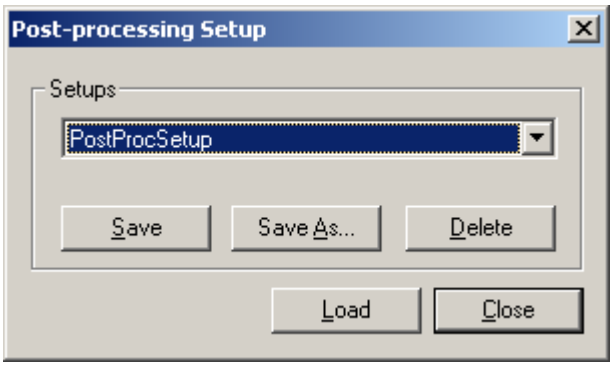
A Chart-file (*.tee) contains all the settings in the **Plot->Chart Settings for Active Plot...** dialog box, except for the curve style settings.

A new Chart-file may be selected from the list of available files. Note that the check box 

must be unchecked, or it will not work properly in this version of WinMLS.
Use the **Save** button to save the current Chart file, the **Save As...** button to save the current Chart file with a new name and the **Delete** button to delete the current Chart file.

5.15 Post-Processing Setup...

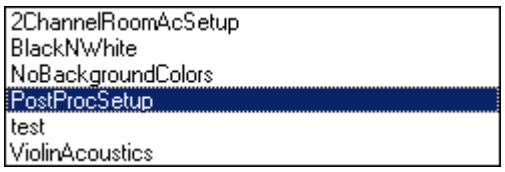
Post-processing setup defines as all the WinMLS settings, except for the measurement settings which are defined in the measurement setup found in the measurement menu.



When WinMLS is exited, the setup filename is saved in registry and all the current settings are saved to a temporary setup. The next time WinMLS is run, this setup file is opened and the settings restored.
To prevent the user from accidentally deleting or overwriting a setup file, the setup files may be write-protected.

5.15.1  Select setup

Displays the selected post-processing setup. Setups are chosen from a list as shown in the figure below.

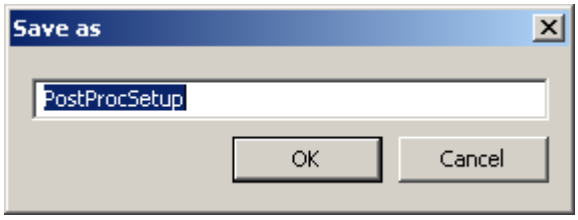


5.15.2  Save setup

Saves the current post-processing settings using the name in the **Setups** combo box.

5.15.3  Save setup as

Opens a dialog box for saving the current measurement settings.



5.15.4  Delete setup

Deletes the selected setup.
The button is disabled when only one setup file is left to make sure not all setups are deleted.

5.15.5  Load setup

Loads the selected setup and then closes the **Post-processing Setup…** dialog box. Note that you will not be asked to save the previous settings.

5.15.6  Close dialog

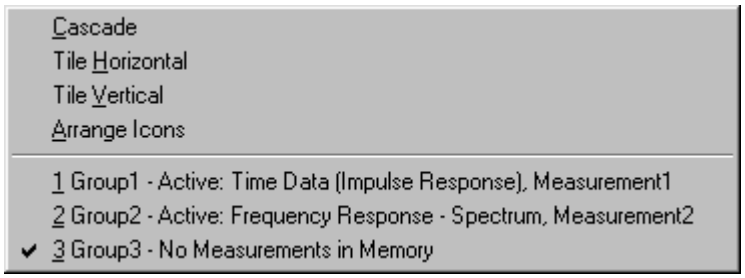
Closes the dialog box. No new setup will be loaded.

6 Room Acoustics

See the **Room Acoustics User's Guide** for documentation on this menu.

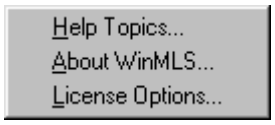
7 Window

This menu contains standard windows settings and a list of the measurement groups as shown below.



8 Help

This menu contains **Help**, **About** and **License** information. **About** contains information about the software, e.g. version number. **Help** and **License** is not yet properly implemented.

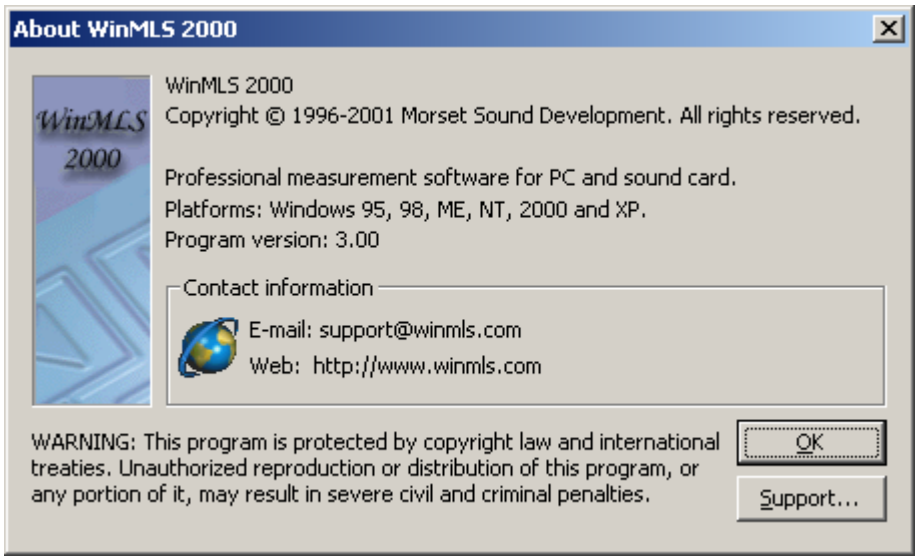


8.1 Help Topics...

Not yet implemented. A help file will be made that can be downloaded from www.winmls.com.

8.2 About WinMLS...

Displays the **About** dialog box.

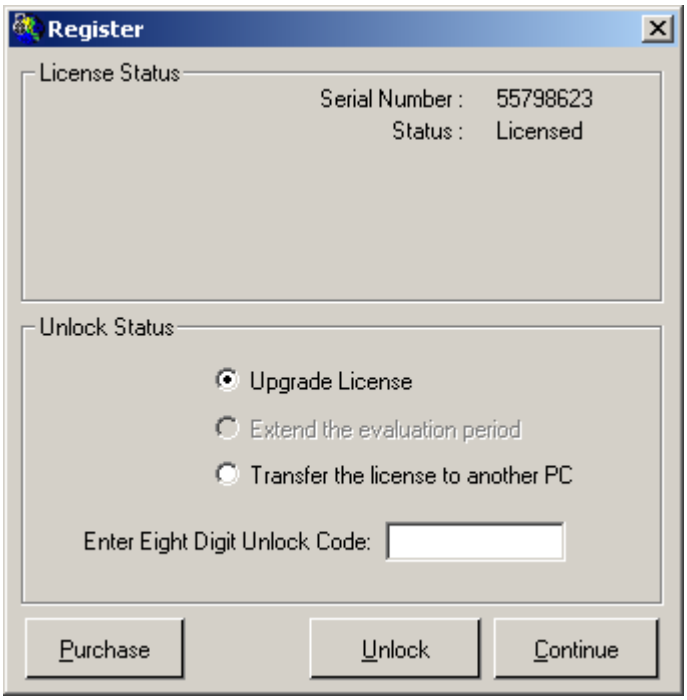


If the 

button is clicked the default Internet browser is opened and the homepage www.winmls.com is visited.

8.3 License Options...

Displays the dialog box for registering WinMLS as shown below.



If the Support... button is clicked the default Internet browser is opened and the homepage www.winmls.com is visited.