

Filter Hose

User Guide v 2.4



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Features

- Easy to quickly create FIR filter based on a measurement or a user defined input
- Create mixed, linear-phase and minimum-phase FIR filters
- Multi-Zone Time Windows to clean input impulse response
- Compatible with Wave, EASERA, Systune, ARTA, and Monkey Forest binary file formats
- Compatible with EASERA, Systune, ARTA, Room EQ Wizard, HOLM Impulse, FuzzMeasure and Smaart ASCII file formats
- Target presets: flat magnitude only (linear or minimum phase filter), flat phase only, flat magnitude & flat phase and minimum phase.
- User defined filter and user defined target curve
- Export filter coefficient in *.csv, *.wav, MiniDSP's *.txt
- Export graph in .png and .emf (vector based)
- Interactive 2D Nyquist plotter (linear and log)
- Numerical data format converter, including freq-mag-phs and freq-real-imag
- Smart smoothing algorithm for the input data
- Manual frequency domain data input
 - o RTA data
 - o Log-spaced frequency domain data
 - Sample rate conversion
 - Incomplete transfer function
 - o User's own creation of a frequency/phase response curve

Compatibility and Known Issues

Windows Platform with Framework 4.0 Client

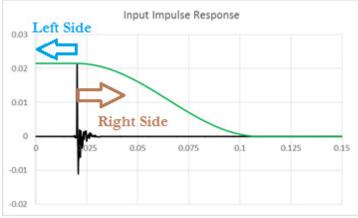
Region and Language of the Operating System: English (USA)

Note: Filter Hose may not recognize operating system setup with comma as the decimal separator.

Recommended display resolution: 1280 x 800 or higher

Application Notes

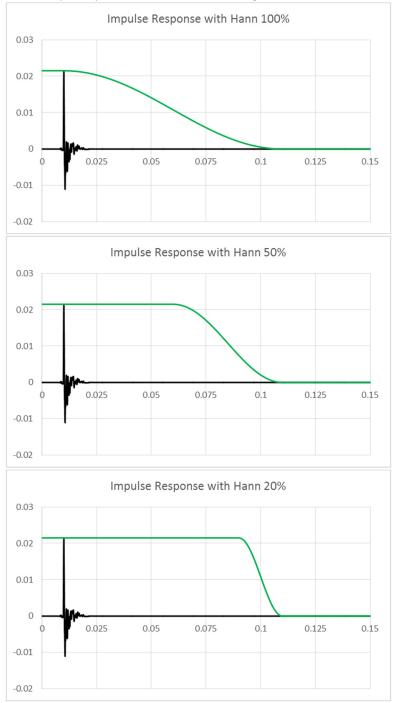
- ✓ Output and filter sample rates depend on the input sample rate. If needed, sample rate conversion can be done via the manual input data (under advanced menu).
- ✓ Windowing for input impulse response [abbreviated as IR from here forward], including multi-zone time windows [abbreviated as MZTW from here forward], is performed at the right half side only with IR peak auto detect.



- MZTW starts at 0.5ms [short] and 1ms [medium, long & room] after the IR peak.
- Hann 50% window always start at the IR peak.
- The left half side of the window is rectangular.
- ✓ MZTW suggested applications:
 - *Long:* Fits perfectly to clean up a ground plane measurement in a very large room or outdoor area. For venue tuning application, this allows early reflections to be included in the IR.
 - o <u>Medium</u>: For general use.
 - <u>Short</u>: For creating loudspeaker correction where good measurement is not possible due to limited room size. Smoothing is likely needed after windowing is applied.
 - <u>*Room:*</u> For creating room compensation EQ, where the minimum length of the window at high frequency is 20ms (>5000Hz), and wider at lower frequencies. This window will include early reflections.
- ✓ Maximum filter tap depends on the input IR length (N) unless the filter is loaded from step 2.
- ✓ Wave file export is fixed @ 8, 16 and 24 bit and float @ 32 and 64 bit. *Filter gain may change due to normalization.*
- ✓ User defined target and user defined filter utilize biquad filter input parameters.

Notes cont'd

✓ Windowing percentage illustration and comparison Hann, impulse peak @ 10ms, window length = 100ms

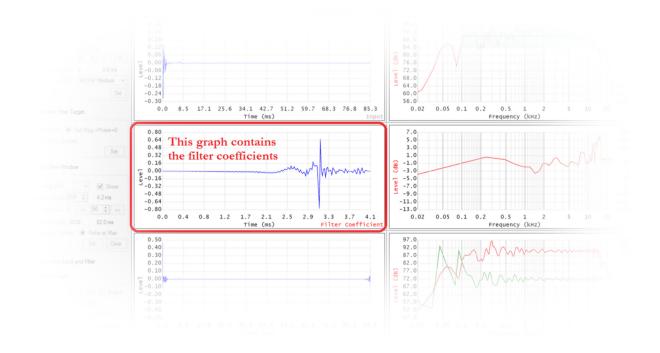


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Navigation

Understanding Filter Hose User Interface





The Five-Step Control Panel

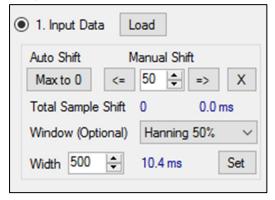
1. Input Data Load
Auto Shift Manual Shift
Max to 0 <= 50 🚖 => X
Total Sample Shift 0 0.0 ms
Window (Optional)
O 2. Choose Filter or Target
Hat Mag. (Linear)?Define
Filter Gain (dB)
O 3. Set Filter Tap
Rectangular 🗸 🗹 Show
Tap Length 1024 束
Shift Tap 0 C <= 50 🜩 =>
Start at Sample 0 0.0 ms
○ Refer at Center
Smooth Filter FR Comp. Shift Clear Set
4. Convolve Input and Filter
Max to 0 🗹 Fast Calculation
◯ 5. Export Filter
○ Wave ○ CSV ○ TXT
O MiniDSP Export
Right Click each graph for more export options.

1. Input Data

Direct load measurement data and provide basic editing such as windowing and cyclic shift. Manual data input can be done via Advance menu – Manual Input Data.

- <u>Choose Filter or Target</u>
 Choose from several target presets or define your own target curve/filter.
- Set Filter Window Define the FIR tap length and provide basic filter's time domain editing.
 Convolve Input and Filter
 - Calculate the convolution of input IR and filter.
- 5. <u>Export Filter</u> Export FIR filter shown in the filter coefficient graph (middle left graph).

Step 1



Click **Load** button to load measurement file directly (no changes on the original data). Alternatively, use Manual Input Data or Dirac Impulse under the Advanced menu to input data to Filter Hose.

Max to 0 button will cyclically shift the IR so its peak is at Oms. *Please note that the impulse should <u>not</u> be cut off at Oms for proper calculation of the predicted output (step 4).* Use Manual Shift to make sure the whole IR is located after Oms.

Manual Shift will cyclic shift the IR based on the selected interval (in sample). If the left side of IR is cut off at Oms, it needs to be shifted to the

right. The X button will clear all shift performed by Filter Hose.

Window (Optional) drop down list contains several windows option to clean up the input IR. Please see the Notes section of the user guide (page 4-5) for more information. If Hanning 50% is chosen, user can define the total window width, relative to the IR peak. The **Width** input value is in sample.

Please click **Set** button to apply the window.

Step 2

Filter Hose provides several targets:

Phase = 0 will flatten the phase response of the input data to 0 degree. Ideally, the magnitude is unchanged, but depending on the property of the filter (step 3), the resultant phase may not be at 0deg at a certain range.

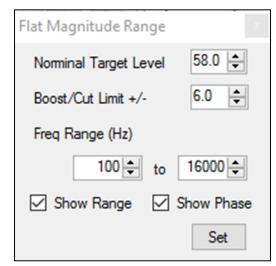
Flat Mag. + Phase = 0 will flatten the magnitude and phase of the input data to a flat line and 0 degree respectively. The actual result depends on the property of the filter (step 3).

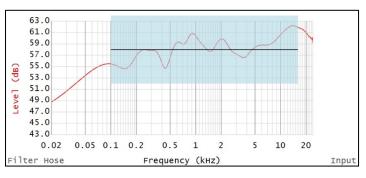
Flat Mag. (Linear) will flatten the magnitude of the input data. Ideally, the phase is unchanged, but depending on the property of the filter (step 3), it may be affected.

Flat Mag. (Min. Phase) will flatten the magnitude of the input data. The filter is a minimum-phase FIR filter. **Phase = Min.** will create minimum phase of the input data based on its magnitude. Ideally, the magnitude is unchanged, but depending on the property of the filter (step 3), it may be affected.

User Defined Filter and Target create custom FIR filter. This will be explained in the other section of the user guide. **Load from *.csv** allows user to load a .csv file as is. The coefficient must use the same sample rate as the input data. **Filter Gain** changes the nominal level of the FIR filter.

۲	2. Choose Filter or Target	
	Flat Mag.+Phase=0 \checkmark ?	Define
	Filter Gain (dB)	0.0
-		





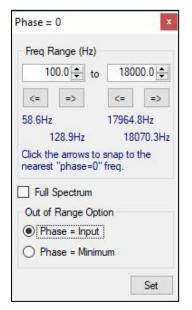
If Flat Mag. + Phase = 0, Flat Mag. (Linear) or Flat Mag. (Min. Phase) is selected as the filter target, Flat Magnitude Range window will pop-up.

Magnitude response will be flattened to the **Nominal Target Level** if it is within the specified **Boost/Cut limit**. Please make sure the light blue

rectangle covers your desired magnitude range before clicking **Set Target**. If the Y-axis is in dBFS, user may input a negative value in the nominal target level box.

Start Freq and End Freq determine the frequency range to flatten.

All parameters are visualized as a black line and a light-blue rectangular, overlapping the magnitude response curve.



If Flat Mag. + Phase = 0 or Phase = 0 is selected as the filter target, Phase = 0 Range window will pop-up.

Start Freq and **End Freq** determine the frequency range for the target phase = 0.

Out of Range Option determines the target phase for the extreme low (0 Hz – *start freq*) and extreme high (*end freq* – Nyquist frequency). User is able to choose minimum phase (**Phase = Minimum**) or original phase (**Phase = Input**).

Full Spectrum will input OHz and Nyquist frequency in the start/end freq range. This option will ignore **outside range** phase target since the whole spectrum target phase will be targeted to be 0 deg. Note: Prior to v1.3, Filter Hose always calculate the whole spectrum for Phase = 0 target.

In v2.1 and newer, user can find **left/right arrows** under the start/end freq range input box. These arrows automatically find the nearest phase crossing point at Odeg (or phase approaches to Odeg) from the input data. For example, the left picture shows that a user intends to flatten the phase from 100Hz. However, the phase is not Odeg at 100Hz.

Continuing with this may not result in a good FIR filter. User can use the arrow to find the phase = 0 crossing point location, in this example either starts at 58.6Hz or 128.9Hz. If user is not satisfied with the automatic finding, user can change the input frequency value, in this example lower than 58.6Hz or above 128.9Hz. The finder will automatically find next frequency crossing points.

Step 3

The most important step to create an FIR filter

3. Set Filter Tap	
Hanning 50%	✓ Show
Tap Length 1024	21.3 ms
Shift Tap 0 C	<= 50 🔹 =>
Start at Sample 158	72 330.7 ms
O Refer at Center	Refer at Max
Smooth Filter FR	Comp. Shift
	Clear Set

The **Window drop down list** contains several window presets to taper the filter's front/end tails.

Show check button will toggle the tap selection area display on and off.

Tap Length determines the filter's tap length. The input value is in sample.

Shift Tap will cyclic shift the filter's IR. The input value is in sample.

0 button will locate the window's starting point at the first sample of the calculated filter's IR. This is useful to create minimum phase FIR filter.

C button will center the tap selection to the peak of the impulse.

Note: Selecting appropriate tap location is the most important step of creating FIR filter. Failure to do so will result in a dysfunctional FIR filter.

Select **Refer at Center** to use the center of the tap area as the left and right window dividing point.

Select **Refer at Max** (default) to use the peak sample of the tap area as the left and right window dividing point. This is the recommended choice for general use.

Check **Smooth Filter FR** to extend the filter's N so that the frequency response display is smoother (finer frequency resolution curve). This option only affects the frequency response view (for viewing purpose only).

Set button will apply the window and tap selection to finalize the FIR filter. Click **Clear** button if the user wishes to experiment with other settings.

After clicking the Set button and if the final FIR filter contains a processing delay (ie. the peak of the filter is far from Oms), the filter's phase response will likely drop and contain a lot of wraps. Activate the **Comp. Shift** checkbox to compensate the sample shift introduced by the Shift Tap. This option only affects the frequency response view (for viewing purpose only).

How do I bypass Step 3 (filter editing)?

When you load a filter that you don't want to edit (ie. Load a .csv file in step 2), you will need to bypass step 3 editing. Please follow the steps below:

- a. Match the tap length.
- b. Use rectangular window.
- c. Click 0 button.
- d. Click Set.

Step 4

4. Convolve Input and Filter
 Max to 0 Fast Calculation

This step convolves the input IR and the filter's IR <u>in the time domain</u>. Then, the frequency response is calculated using DFT/FFT, based on the new calculated IR. **Note: DFT requires significantly longer process time if IR has N larger than 8192.**

To use FFT, please select **Fast Calculation (**by default). To use DFT, please unselect **Fast Calculation** (more accurate result). FFT or DFT choice only affects the frequency domain data.

If Max to 0 checkbox is selected, the peak of IR will automatically cyclic shifted to Oms (default).

Tip: If one needs to cyclic shift the calculated output, please use *Send to Input* or *Send to New Window* under Advanced Menu. Using this option, the IR will be loaded to the input (step 1) section of Filter Hose.

Step 5

5. Export Filter		
🔾 Wave 🏾 🖲	CSV	O TXT ○
O MiniDSP		Export
Right Click each export options.	n graph fo	or more

This step allows user to export the filter coefficients. User can also export the filter by using right click on the filter coefficient graph (middle left IR graph).

User Defined Filter

Х 🜌 User-Defined Filter 15.0 100.0 12.0 96.0 92.0 9.0 88.0 💮 6.0 (gp 84.0 3 3.0 Filter Level 80.0 🐷 0.0 é -3.0 76.0 -6.0 72.0 2 -9.0 68.0 -12.0 64.0 -15.0 60.0 50 100 500 10 20 200 1k 2k 5k 10k 20k Filter Hose Frequency (Hz) User-Defined Filter Graph Settings Freq Gain Filter Type Q BW Output Level (dB) Bypass Filter Level (dB) (Hz) (dB) specify min. to max. specify min. to max. 50.00 High Pass \sim 0.71 1.89 0.00 \Box 60.0 \$ to 100.0 \$ -15.0 🜩 to 15.0 🌲 PEQ \sim 0.50 2.54 1400.00 -2.00 or specify center and ± range or specify center and ± range Tilt Log 0.09 7.00 500.00 \Box 0.0 🜩 ± 80.0 🗢 🛨 20.0 🜲 \sim -6.00 15.0 🌲 Show Auto Range PEQ \sim 5.00 0.29 190.00 4.00 CSV File (Optional) Double Click to Load *.csv File ref 0.0 200 🗘 to 24000 🜲 Level (dB) Bypass Use Phase Options Bypass Refresh Phase = 0 \sim Send Right Click table for more options. fs = 48000 Hz; N = 4096 Cursor: 12.7Hz, Left=6.6dB, Right=88.8dB

User is able to define a filter/EQ curve based on .csv file load, biquad filter input or other controls.

The green curve shows the magnitude of user defined EQ and the red curve shows the magnitude of the predicted output. User is able to edit the table on the left by defining biquad input or other available filter to create the EQ. Please always click **Refresh** button (or hit enter) to refresh the graph after performing any edits. Use **right-click** on the table area to add/remove filters. To change the graph color, please click on the color button on the right of the min/max value.

User can also save/load these table separately. Please use **right-click** on the table. **Save IIR filters** will save the current table to a .iir file, **Load IIR filters** will load and replace the current table and **Add IIR filters** will add the saved parameters to the current table.

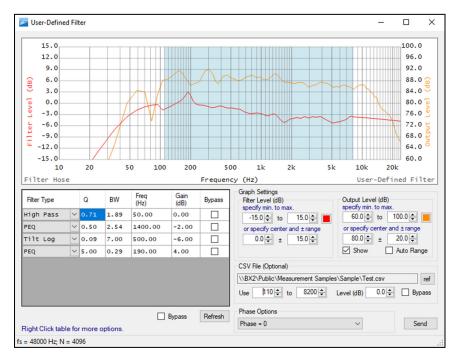
Phase Options define the final FIR filter's phase. There are four options:

1. Phase = 0

Creates an FIR filter with phase = 0. This will ignore the biquad minimum phase filters from the table.

- Phase = Min.
 Creates a minimum phase FIR filter. This option will calculate a minimum phase from the loaded csv file.
- Use CSV phase, table phase = 0
 Combines the loaded csv file with the filters defined in the table and set the phase from the table to 0deg.
- Use CSV phase, table phase = Min.
 Combines the loaded csv file with the minimum phase filters defined in the table. Note: Selecting non-minimum phase filter in the csv file will result in a mixed-phase (hybrid) FIR filter.

For a certain selection, user is able to define the magnitude range of the loaded .csv file. The graph will show the selected range in the blue rectangle as shown in the picture below.



Note: loading .csv file in user defined filter window requires a same N length with the loaded measurement. Filter Hose will automatically shorten/lengthen the loaded .csv file.

User Defined Target

User is able to define a target curve. The output (step 4) frequency response will likely result closely with the defined target curve in the this window (depends on the step 3) unless user selects filter phase = 0 or filter phase = Min.



The **nominal target level** is always calculated based on the input. Please make sure to adjust the nominal target level first prior to modifying the table.

User can save/load these table separately. Please use **right-click** on the table. **Save IIR filters** will save the current table to a .iir file, **Load IIR filters** will load and replace the current table and **Add IIR filters** will add the saved parameters to the current table.

Phase Options define the target curve's phase response, or assign a certain phase characteristic to the created FIR filter (target curve is used for magnitude correction only). There are six options:

- Phase = 0 Creates a target curve with phase = 0.
- Phase = Min.
 Creates a target curve with minimum phase response.
- Use CSV Phase, Table Phase = 0 Combines the loaded csv file with the curve defined from the table (phase = 0).
- Use CSV Phase, Table Phase = Min.Combines the loaded csv file with the curve defined from the table (phase = Min.).
- Phase = Input (Filter Phase = 0)
 Creates an FIR filter with phase = 0, with the target magnitude curve defined in the table, CSV file or combination.
- 6. Filter Phase = Min.

Creates a minimum phase FIR filter, with the target magnitude curve defined in the table, CSV file or combination.

Note: loading .csv file in user defined filter window requires a same N length with the loaded measurement. Filter Hose will automatically shorten/lengthen the .csv file.

Limiting the frequency range

Currently, the filter's table in the user defined target can't be constricted to a certain range only. Should you need to do this, please follow the steps below:

- 1. Use the user defined target as you wish without the range limitation. Create an FIR filter and finish it in step 3.
- 2. Save the FIR filter as a .csv file.
- 3. Go back to step 2 and choose user defined filter.
- 4. Load the newly created FIR filter in the user defined filter. Notice under the loading function, user can limit the frequency range where the filter affects.

Available Filter Types

To define a frequency response curve in user defined window and user defined target, user is presented with several options:

- Biquad high pass filter (HPF) User is required to define the frequency and Q/bandwidth.
- Biquad low pass filter (LPF)
 User is required to define the frequency and Q/bandwidth.
- Biquad high shelf (HS)
 User is required to define the frequency, gain and Q/bandwidth.
- Biquad low shelf (LS)
 User is required to define the frequency, gain and Q/bandwidth.
- Biquad all pass filter (APF)
 User is required to define the frequency and Q/bandwidth.
 This is a non-minimum phase filter.
- 6. Parametric EQ (PEQ)

User is required to define the frequency, gain and Q/bandwidth.

7. Tilt Log

User is required to define the start frequency (lower limit), gain and bandwitdh (how many octave up?). Example: if user wishes to have a -3dB spectral tilt from 5000Hz – 15000Hz, input the parameters as follow: Frequency = 5000Hz Bandwidth = 3 octaves (Note: 15000Hz is three octaves higher from 5000Hz). Gain = -3dB.

This is a non-minimum phase filter.

8. Tilt Linear

User is required to define the start frequency (lower limit), gain and bandwitdh (how many octave up?). Please see the example from number 7 above.

This is a non-minimum phase filter.

Note: each biquad filter is a second order filter.

Mouse Navigation on Each Graph

✓ Left-Click on graph:

Shows the cursor location.

✓ Right-Click:

Shows the export menu, graph setup, peek window and other options.

✓ Control Right-Click:

Pops up the graph property window.

- ✓ Control Left-Click + drag: Horizontal zoom in.
- ✓ Shift Left-Click + drag: Vertical zoom in

✓ Double Left-Click:

100% zoom out and activate the auto range.

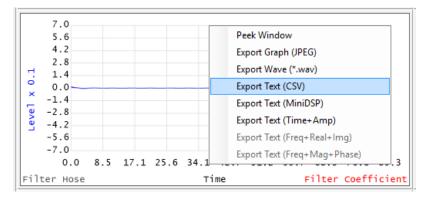
Peek Window

Larger view for each graph is available, user can access peek window by right clicking each graph and select peek window option. The data in the peek window is not affected if changes are made in the main Filter Hose window.

User is able to rename the peek window's name to keep track what data is shown in a peek window, especially if multiple peek windows are opened.

Exporting FIR values

User can export FIR filter coefficient from step 5 or right-click on the time-domain filter's graph (middle left graph - as shown below).



Exporting High-Resolution Vector-based Graph

Vector-based graph export (.emf) is introduced in Filter Hose V2.3 and beyond. Please use **right-click** on the graph you wish to export, select export graph, and toggle the type between .png or .emf.

Project Save/Load

Under the file menu in the main window, user can save/load the Filter Hose project. This will save/load all values/settings in Filter Hose from step 1 to step 4.

Filter Hose .csv File Format

The .csv file format that Filter Hose recognizes (export and import) follows the following screenshot.

Choose CSV Format	
Coefficients in a column, no seperator	
0.969927 -0.06016 -0.0601 -0.0598 -0.05927 -0.05852 -0.05758 -0.05646 -0.05518 -0.05375	^
-0.05218	Ŷ
 Coefficients in a row, seperated by comma 	
0.969927, -0.06016, -0.0601,-0.0598, -0.05927, -0.058 0.05758, -0.05646	52
0	К

Manual Time Domain Data Input

If a software exports a time domain data ASCII file (.txt or .csv) that is not recognized by Filter Hose, user can manually edit the data in the notepad or excel to include only the IR's amplitude data, and format it in a column with no separator or in a row separated by comma. Then save it as a .csv file. User can also rename a .txt file to a .cvs file. This enables a flexibility to manually input time domain data to Filter Hose. This is also explained in the sub chapter importing a filter transfer function at the end of the user guide.

Known Hardware Compatibility

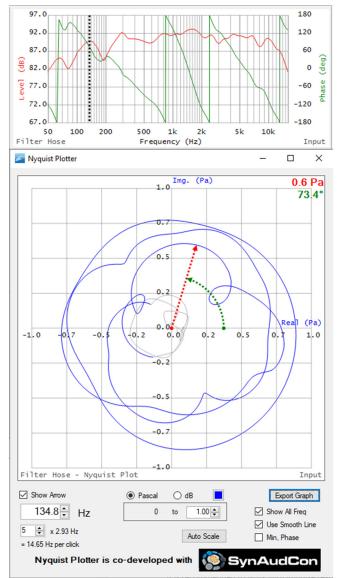
Coefficients in a column is recognized by DSP such as QSC Q-sys, Marani Audio, Symmetrix, DFM Audio, etc.

Coefficients in a row, separated by comma is recognized by DSP such as Biamp Tesira.

The above examples were tested in 2018 and may change in the future. Please always check with your DSP manufactures. Should you find a DSP input format that is not recognized by Filter Hose export function, please contact us.

Interactive 2D Nyquist Plotter

An interactive 2D Nyquist plot is included in Filter Hose V2.3 and beyond. Use **right-click** on each frequency domain data graph in Filter Hose main window to access the Nyquist plotter.



This Nyquist plotter is an interactive window and is linked to the main window's related graph.

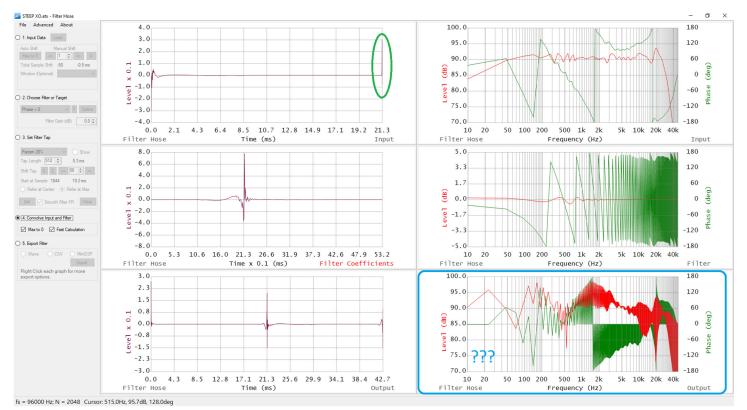
Show arrow checkbox will toggle the pointer on/off. Show All Freq checkbox is controlled by the graph setting window (including using the mouse click to do zoom in/out). Frequencies that are not shown in the main graph window will not be displayed as grey if it is checked.

Use Smooth Line checkbox will smooth out the view of the Nyquist plot, especially at low frequency resolution area. **Min. Phase** check box is only available on the input transfer function graph. This will toggle the input data to minimum phase.

Pascal / dB button toggles the view in log or linear graph.

Getting a Good Output Prediction

Here is a example of a filter creation screenshot where the user uses Max to 0 on the input data (step 1). The filter is created to flatten the phase with 2ms of processing delay. Please notice the input impulse response is chopped (marked by green circle on the left top graph). The FIR filter created is valid, however step 4 will result in a weird output frequency response, see the right bottom graph marked with light blue rectangle.

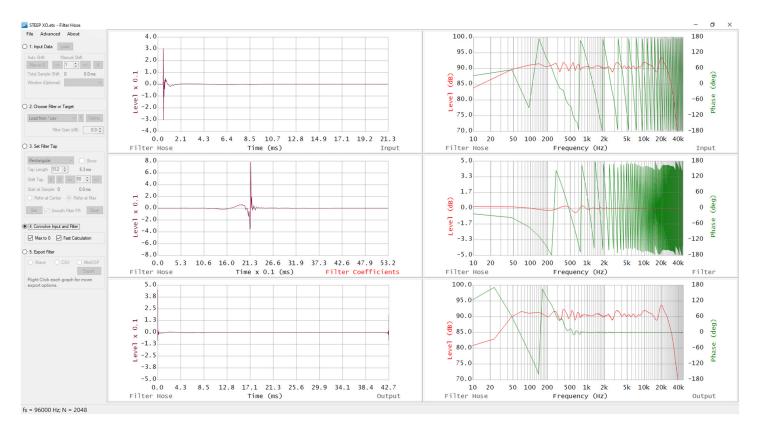


How can user get a good output prediction in this case?

As explained previously, step 4 uses <u>time domain</u> data convolution to calculate the output prediction. When the input impulse response is chopped at 0ms, this will result in a weird output. To solve this, please follow the step-by-step below:

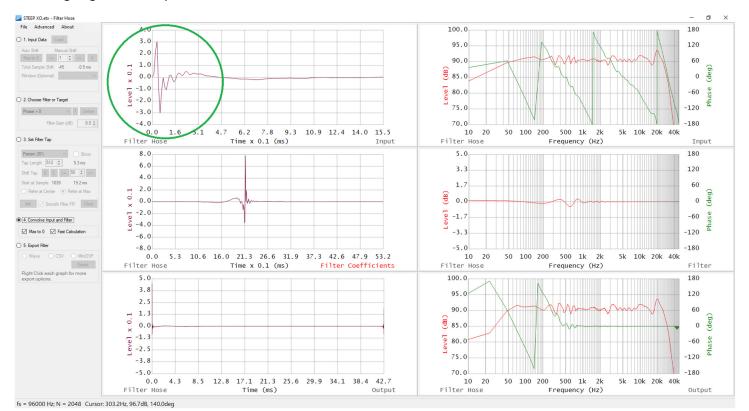
- Save the FIR filter to a .csv file.
- Go back to step 1 and move the impulse' peak far from 0ms. User can cyclic shift the whole impulse response to the right, for example 100 samples (ignore the phase response wrap).
- Reload the saved FIR filter on step 2 using load from *.csv.
- To make sure step 3 does not alter the saved filter (bypassing step 3 editing feature):
 - a. Match the tap length.
 - b. Use rectangular window.
 - c. Click 0 button.
 - d. Click Set.
- Proceed to step 4, and you can see the correct result.

Please observe the screenshot on the next page, the right bottom graph is now correct and the right top graph will show more phase wraps due to the shifted IR location.



Note: if phase wraps are obstructing the view of the frequency response graph, user can deactivate the phase view from the graph setting.

Alternatively, user can start by properly placing the impulse response's earliest energy arrival in step 1. Please see the next screenshot of the same input data. The impulse response is adjusted so all of the impulse energy is located after Oms. When user proceeds in creating the filter and observing the output, step 4 will show a good prediction without the need of going back to step 1.



For more information about this, user is invited to read our article: A Meaningful Loudspeaker Phase Response. The article is downloadable from <u>www.HXAudioLab.com</u> – Publications.

Advanced Menu

In Filter Hose v1.2 and newer, advanced menu is introduced.

Filter (also available for Input/Output)- Send Filter to Input/New Window

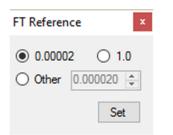
When a filter is already generated, this function enables user to send the filter (time domain) to the data input or a new instance of Filter Hose window. This is useful when creating a mixed-phase FIR filter or tweaking the FIR filter. A similar way can be done by saving the filter as a .csv file and loading it to the data input. Please see the section on Importing a Filter Transfer Function in this user guide. The FT reference is automatically set to 1.

Filter – Flip Polarity

Flips the polarity of the filter. This function is active after a filter is created.

Input - FFT Reference

User is able to define a reference value for the Fourier transform. This will affect the level in the frequency response.



If send filter to input is clicked, the FT reference is automatically set to 1. After changing the FT reference, user shall reload the input file.

Input - Flip Input Polarity

Flips the polarity if the input.

Input – Dirac Impulse

Filter Hose will automatically input a Dirac delta function to the input. This enables user to create their own filer using user defined filter/target selection or test their own Filter.

Input - Remove 2nd Half of N

This function shorten the data input N by eliminating the last half samples and the function works for N > 1024. Please make sure the impulse is not chopped incorrectly by shifting the peak to near beginning/0ms.

Tips on shortening Input N

Several programs collect long impulse response by default and may cause Filter Hose "not responding". To shorten the data input, please follow the steps below

- 1. Load a data (assuming N > 64k) and wait.
- 2. Click on Max to 0
- 3. Cyclic move the impulse at least 50 samples to the right (to avoid the impulse getting chopped).
- 4. Use Advanced Input Remove 2nd half of N function, one to three times to shorten the impulse length.

It is recommended to work with impulse response with $N \le 16k$ to avoid the slow response of the program. If a wave file is used, use wave editors to shorten the length of the impulse response to under 2 seconds.

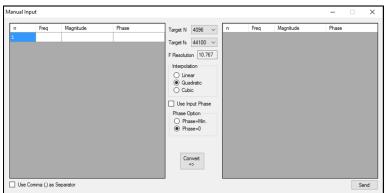
Input - Smooth

This function will smooth the input data to approximate 1/3, 1/6 or 1/12 octave smoothing. User is able to repeatedly apply this function.

Input – Phase to Min. / Use Original Phase

This function will calculate and show the minimum phase from the input data. The function can toggle back to the original phase data.

Input - Manual Input Data



Clicking this function will pop-up a new window as shown on the left. This window enables user to:

- Load an RTA data
- ✓ Load a log-spaced frequency domain data
- ✓ Do a sample rate conversion
- ✓ Load an incomplete frequency domain data
- Create a custom frequency domain data input

The user input is located on the left table. User is able to copy-paste text/ASCII data from notepad or Excel or other similar software. It accepts log or linear frequency domain data, including incomplete transfer function.

By unchecking **Use Input Phase**, Filter Hose offers two options on how the phase will be generated: minimum phase (calculated from the magnitude data) or phase = 0 deg. This step is required to create a phase curve from RTA data, or if user wish to overwrite the current measured phase data.

Please define the target sample rate (fs) and N before clicking **Convert**. The new data set will be transferred to the main Filter Hose window by clicking **Send**.

The pasted data on the left table may contain rows that are not acceptable to Filter Hose. Please use right click on the row to perform editing. Several table editing options can be seen below.

n Freq	Magnitude	Phase	Target N	4096 ~	n	Freq	Magnitude	Phase	
		Copy Paste Remove Empty Rows Delete Selected Conte Add Row Unselect All Remove Selected Row Remove All Rows	Ctrl+C Ctrl+V Ctrl+R ent Del	44100 ~ on 10.767 tion ar idratic ic put Phase					

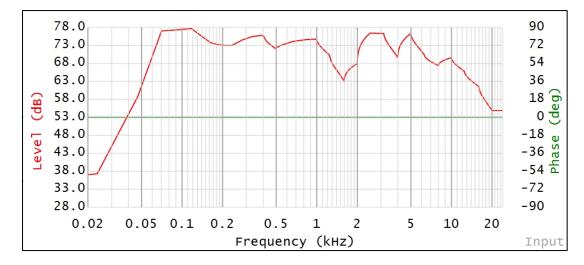
Note:

- 1. <u>Target N refers to time domain data N</u>, therefore the data in the right table will contain <u>half</u> of the selected target N value.
- 2. Manual input <u>always</u> perform interpolation/extrapolation to create a new (linear frequency) data set. To import the data without any changes, please use the direct load button (Step 1 from the main window).
- 3. User is able to create her/his own frequency/phase response by inputting the value in each row manually.
- Please refer to HX Audio's article: <u>Creating Earthworks Mic Compensation in EASERA and Systume using Filter</u> <u>Hose</u> for an application example of the manual input where user inputs an incomplete data and customizing a lower frequency curve manually.

Manual Input Example – Loading an RTA data

About Adv	File Edit	Format View]	10-	•					
	Help							107. 105.					\sim	
) 1. Input Data	Hz dB	^						103.				$\backslash \land$		
Auto Shift	16.0000	32.1721						101.				\smile		
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Total Sample S	31.5000	46.5420									/			Ŋ
Window (Optic	40.0000	49.3801						95. 93.						
innuon (opiio	50.0000	59.9069					Manual I	nput				-	- 🗆 🛛 🕹	
	63.0000	71.9964												
2. Choose Filt	80.0000	78.8461	n	Freq	Magnitude	Phase	A Target N 204	48 ∨	n	Freq	Magnitude	Phase	^	20
2. 010000 11	100.000	77.0346 77.8311	1	16.0000	32.1721					0.000	32.172	0.000		
Phase = 0	160.000	74.0281	2	20.0000	33.3393		Target fs 480	₩ 000	2	23.438	37.327	0.000		
	200.000	73.0163	3	25.0000	37.9616		F Resolution	23.438	3	46.875	58.797	0.000		
3. Set Filter V	250.000	73.0276	4	31.5000	46.5420		Calculation		4	70.313	77.040	0.000		
Hanning 20%	315.000	75.1697	5	40.0000	49.3801		O Linear		5	93.750	77.372	0.000		
-	400.000	75.8267 71.9763	6	50.0000	59.9069		Quadrati	c	6	117.188	77.700	0.000		
Tap Length	630.000	73.7646	7	63.0000	71.9964		O Cubic		7	140.625	75.483	0.000		
Shift Tap	800.000	74.5179	8	80.0000	78.8461		Use Input F	hase	8	164.063	73.718	0.000		
Start at Sample	1000.00	74.7722	9	100.000	77.0346		Phase Option		9	187.500	73.198	0.000		
Refer at Ce	1250.00	70.2007	10	125.000	77.8311		O Phase=1		10	210.938	73.022	0.000		
	1600.00	63.0804	11	160.000			Phase=0)	11	234.375		0.000		20
Set 🗸 S	2000.00	67.9690 76.4732	12	200.000			_		12	257.813	1.2.0.0.0.0	0.000		
	3150.00	76.3421	13	250.000			-	_	13	281.250		0.000		
4. Convolve I	4000.00	69.6067	14	315.000			Convert		14	304.688		0.000		
Max to 0	5000.00	76.3421	15	400.000			=>		15	328.125		0.000		
	6300.00	70.3477					~						×	1
5. Export Gra	8000.00	67.3916 69.6268	Use C	Comma (.) as Se	eparator							Ser	nd and Close	
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_	16000.0	61.5329						l 95. 93.						
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Export Select								89. 87.						
Right Click e			.0 36.3	72.5 108	.8 145.1 181.3	217.6 253.9 290.	1 326.4 362.6		0.02	0.05 0.1	0.2 0.5	1 2	5 10	
data in variou					Time (ms)		Output					cy (kHz)		

An RTA data is copy pasted from notepad. The data is transferred without phase information, and filter hose is inputting phase = 0. To do this, please unclick **Use Input Phase** and select the desired option. The input result can be seen below (48kHz sample rate, N=2048).



Settings

Settings	
CSV File Export Format CSV File Export Format Coefficients in a column, no seperator 0.969927 -0.06016 -0.0601 -0.05375 -0.05218 Coefficients in a row, seperated by comma 0.969, -0.06, -0.060, -0.059, -0.058	Line Color at Launch Time Response Magnitude Response Phase Response Nyquist Plot Default Colors Show Phase Effective after Restart OK

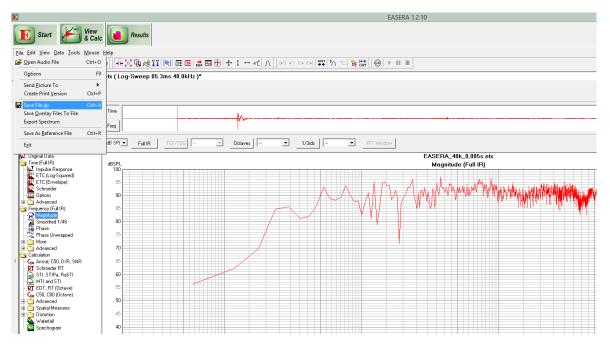
The settings window is introduced in Filter Hose V2.3. The .csv file format compatibility can be found here. **Show phase** check box allows user to turn off the phase display by default. The line colors for the program can be changed via this settings window. Some changes may require a restart of Filter Hose.

Direct Import ASCII Measurement Files

Direct load only accepts 2ⁿ measurement data length.

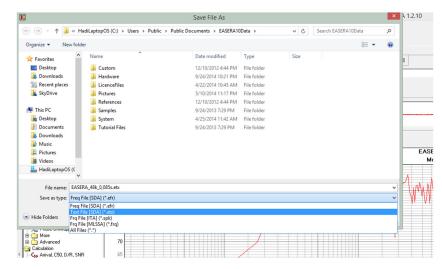
EASERA .etx file (Tested using v1.2.13)

Filter Hose is able to load time and frequency domain EASERA .etx files. The example below is in frequency domain.



Click Magnitude on the left panel

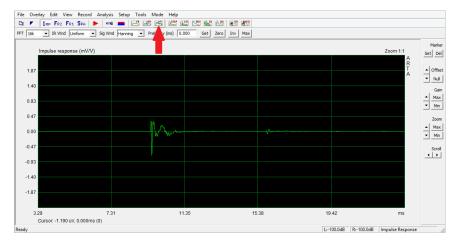
Click File – Save File As

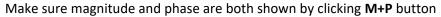


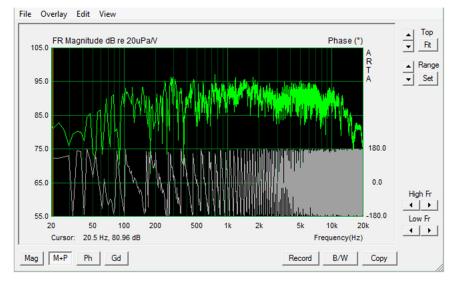
Select Text File *.etx from the drop down menu

ARTA .txt file (Tested using v1.8.5)

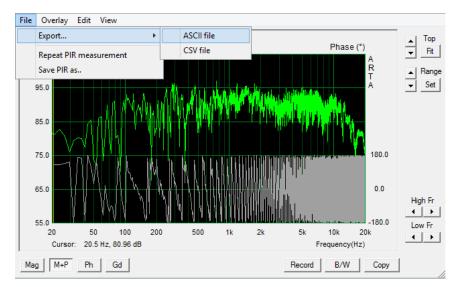
Click **DFT** (unsmoothed FR)







Click File – Export – ASCII file



Systune .etx file (Tested using V1.3.7)

Click File – Save Audio As – Impulse Response to create an .etx file from Systune. We recommend using Systune's time domain etx data format.

					AFMG	SysTune v1.3.5
File Configure View Help						
Open Audio File Ctrl+O litor	Input	Levels	Transfer Function	Results	External	
Open Streaming Audio File	Time Signal Spectrum Spectrogram	NC Histo	IR ETC Mag	Phs RT STI	Plug-Ins Virtual EQ	
Save to Audio File	Time Signal					
Send Upper Picture To	ImpulseResponse					
Send Lower Picture To	Frequency Response					
Export Data As Text 🕨	Windowed Frequency Response					
Options F9						
Open Setup File	1.0					
Save Setup File	0.8					
Open View File	0.5					
Save View File	0.3					
Exit	0 — — — — — — — — — — — — — — — — — — —					
Play Signal	-0.3					
Signal: Log Sweep 85.33 ms Select	-0.5					
Play Channel:	-0.8					
Parameters	-1.0					
FFT Size: 85.33 ms; 4096; 11.72 Hz -	-1.3					_
	-1.5					
Averages: Reset 4 (0.34 s)	-1.8	إلىسم				
Capture Measurement	-2.0					
Overlays Levels	-40 -35	-30	-25	-20 -1		-5
dBES 0 dBES 0					-42.	54 ms 5.92

From the file dialog, select *.etx.

File name:	Current Measurement.etm	
Save as type:	Time File [SDA] (*.etm)	
	Time File [SDA] (*.etm) Wave File [MICROSOFT] (*.wav)	
	Text File [SDA] time domain (*.etx)	
	Audyssey File [AMS] (*.ams)	μ

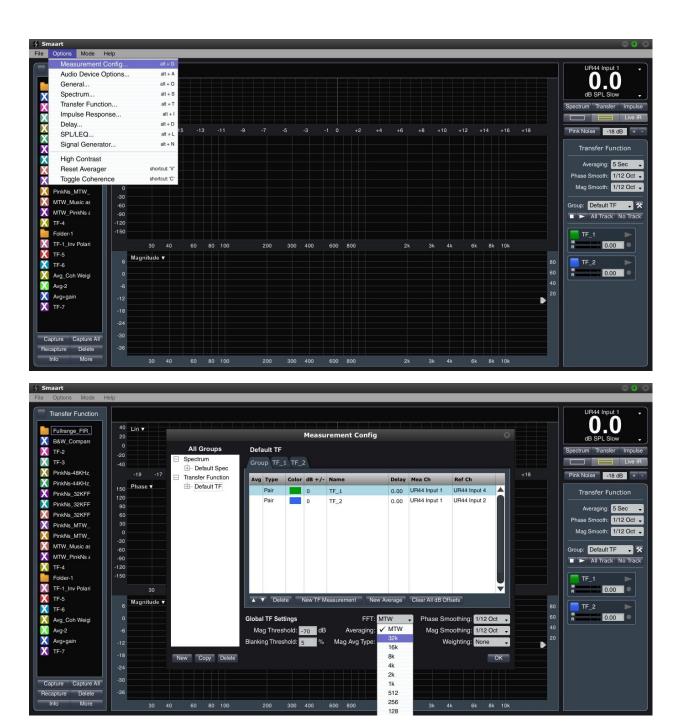
In Filter Hose, please use EASERA *.etx file type to import the file.

Smaart .txt file (Tested using v7.5.2 and v8.4.3)

To improve the transfer accuracy, we recommend using the linear data: Click **Measurement Config** and switch the MTW to an FFT size. If MTW data is preferred, the Filter Hose direct load will automatically load the values to the manual input. The user will need to set the sample rate, click Convert and then click Send.

In Smaart, please make sure the coherence blanking threshold is set to 0% (circled in red below and highlighted in yellow).

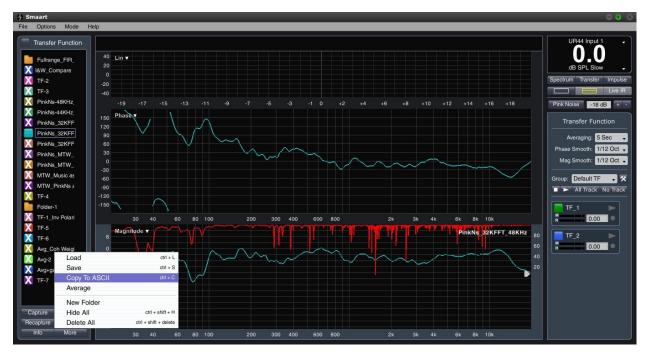




Another way to open **Measurement Config** is to press the tool button as shown below:



Click More – Copy to ASCII



The values are stored in the clipboard. Open Notepad to paste in the values, and save as a new text file (*.txt), or you can paste the value directly to the Filter Hose Manual Input window.

Room EQ Wizard/REW (Tested using v5.19)

Click File – Export – Impulse Response as text to create a compatible txt file for Filter Hose use.

Please note that REW impulse length is default to N > 64k. Upon loading the txt file to Filter Hose, it is recommended to use **Advance – Input – Remove 2nd Half of N** to shorten the impulse length at least to N <= 16k. Please see "Tips on Shortening Input N" section in the user guide.

lle	Tools Preferences Graph Help					
	Measure	Ctrl+M				
	Open Measurement	Ctrl+O		IR Windows SPL Meter Generator		
	Save Measurement	Ctrl+S				
	Save All Measurements	Ctrl+Shift+S	D	SPL & Phase All SPL Impulse Filtered IR		
	Open Filters	Ctrl+Alt+O	Jre	Siedermase Ansre Impaise Intered to		
	Save Filters	Ctrl+Alt+S	ir.			
	Import Frequency Response	Ctrl+I				
	Import Impedance Measurement	Ctrl+Alt+I				
	Import Impulse Response	Ctrl+Shift+I				
	Export	÷		Impulse Response as WAV		
	Remove Current Measurement	Ctrl+Backspace		Filters Impulse Response as WAV		
	Remove All Measurements	Ctrl+Shift+Backspace		Filter Settings as text		
	Restore Last Removed			Measurement as text		
	F.:4			Measurement as MLSSA .frq		
	Exit			Impulse Response as text		
		3		RT60 data as text		
				Set text delimiter (Space)		
		2	20			

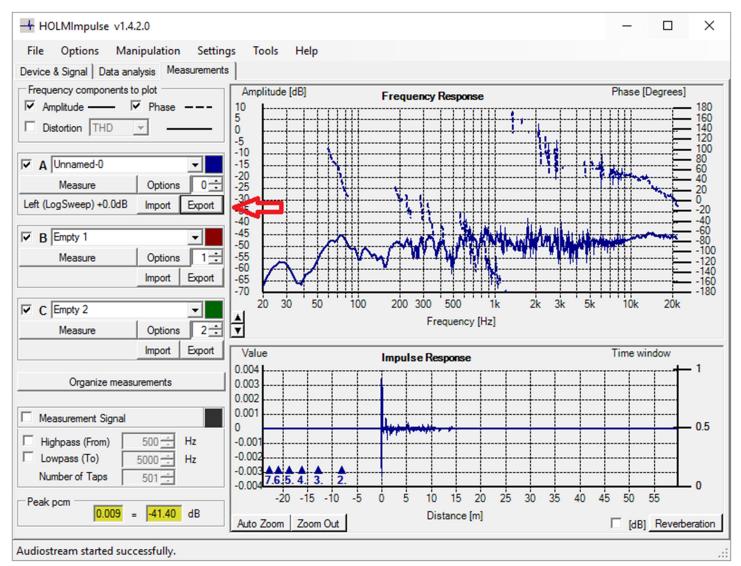
FuzzMeasure

Filter Hose accepts FuzzMeasure time domain data export (.csv file). Please make sure the exported csv file contains the time (ms) and amplitude of the impulse response as shown below (opened in Excel and NotePad).

		r c≫ - ∓ INSERT		FORMULAS	example 2.csv - Excel ? DATA REVIEW VIEW DEVELOPER TEAM Hadi Sumoro *	×
Pa	X	Calibri • B I U • E • Font	РАGE LAYOUT 11 - А́ А́ · <u></u> А́ А́ -		General • \$ • • % • \$ \$ • • % • \$ ₩ Format as Table * ₩ Cell Styles *	
A	L		< 🗸 fx	Time (ms)	example 2.csv - Notepad –	×
	А	B C	D	E F	File Edit Format View Help	~
1	Time (ms)	V/Vmax				
2		0.003384			Time (ms),V/Vmax,0.000000,0.003384,0.020833,-0.0	
3	0.020833	-0.01008			386,1.104167,0.001317,1.125000,0.003267,1.145833	
4	0.041667	0.008747			02679,2.229167,0.002504,2.250000,0.003127,2.2708	3:
5	0.0625	-0.00137			.003967,3.354167,0.001039,3.375000,0.002647,3.39	5
6	0.083333	0.006908			,0.003361,4.479167,0.003186,4.500000,0.002660,4.	
7	0.104167	-0.00125			333,0.002619,5.604167,0.000610,5.625000,0.002098	
8	0.125	0.005864				
9	0.145833	0.000251			08333,0.003811,6.729167,0.000760,6.750000,0.0033	
10	0.166667	0.003924			7.833333,0.003306,7.854167,0.002733,7.875000,0.0	
11		-0.00036			500,-0.313363,8.958334,-0.162866,8.979167,-0.039	6
12	0.208333				041667,0.019755,10.062500,0.013191,10.083334,0.0	71
13	0.229167	0.00118			0.282737,11.104167,0.087212,11.125000,0.179258,1	1
14		0.003941			000,0.018634,12.145834,0.005057,12.166667,0.0146	
15	0.270833				66667,0.025426,13.187500,-0.123976,13.208334,-0.	
16 17	0.291667	0.004532				
18	0.333333				08334,0.048231,14.229167,0.161621,14.250000,-0.0	
19	0.354167	0.00082			3398,15.250000,-0.148549,15.270834,0.021670,15.2	
20		0.003836			291668,-0.019917,16.312500,-0.019088,16.333334,-	0
21	0.395833				,-0.058562,17.333334,0.002590,17.354168,-0.00032	1
22	0.416667				8.375000,0.047724,18.395834,0.063955,18.416668,0	
23		0.001358			039159,19.437500,0.003256,19.458334,0.024324,19.	
24	0.458333	0.003979			,0.008826,20.479168,-0.011703,20.500000,0.036459	
25	0.479167	0.001247				-
26	0.5	0.003644			012490,21.520834,-0.000523,21.541668,0.025122,21	
27	0.520833	0.00116			09,22.541668,-0.034768,22.562500,0.033199,22.583	
28	0.541667	0.003964			01109,23.583334,0.008287,23.604168,0.000120,23.6	2!
29	0.5625	0.001331				
30	0 583333		0		٢	>
	4	example 2	(+)			

Holm Impulse (Tested using v1.4.2.0)

Filter Hose accepts time and frequency domain data export from Holm Impulse.



Export response to file	×	Export response to file Filename C:\Users\Hadi\Desktop\HolmTest-freq.txt		
- Filename				
HolmTest				
Frequency Impulse Text Options	Browse	Frequency Impulse Text Options	Browse	
Export impulse response File Format C Wave file Time window From [sample] -8193 to [sample] 8191 Wave file options Format: 32 bit float Image: Normalize to magnitude = 1 Text file options Image: Include sample numbers in text file	Close	Export Frequency Response • Custom format • HOLM calibration file • One line (Freq, dB, phase) - OrCAD PSpice Frequency range • Full • Custom Frequency range • Full • Custom From [Hz]: 10 to [Hz]: 24000 ✓ Export Phase • Degrees Unwrap phase ✓ Frequency increments • Non-Equidistant Unwrap in amplitude [dB]: 0.10 Max change in phase [deg]: 1.0 • Linear Increment [Hz]: 5 •	Close	
		C Logarithmic Number of points: 1000 -		

Please follow the setup in the left screenshot for time domain export or the right screenshot for frequency domain export.

The .txt file shall look like the pictures in the next page.

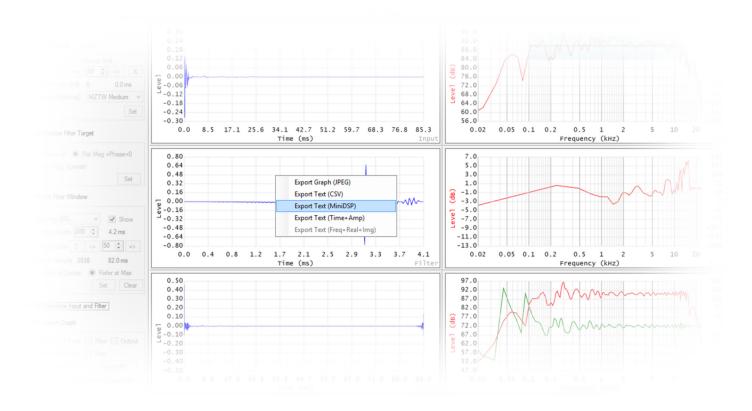
🗐 HolmTest-freq.txt - Notepad - 🗆 🗙	🗐 HolmTest-time.txt - Notepad — 🗆 🗙
File Edit Format View Help	File Edit Format View Help
# '	· # ^
# Measurement exported using HOLM Acoustics	# Measurement exported using HOLM Acoustics
software	software
# http://www.holmacoustics.com	<pre># http://www.holmacoustics.com</pre>
#	#
# Note: Unnamed-0	# Note: Unnamed-0
# Number of samples: 16384	# Number of samples: 16384
# Samplerate: 48000	# First sample number in file: -8193
#	# Last sample number in file: 8191
# All discrete frequencies are included	# Samplerate: 48000
#	#
<pre># Frequency [Hz]; Amplitude [dB]; Phase</pre>	#
#	## sample; Amplitude
0;-107.3349221;0	-8193;0
2.9296875;-78.2020589123;33.451432286	-8192;0
5.859375;-76.6466231685;-93.5699968278	-8191;0
8.7890625;-68.4545615704;-174.478481173	-8190;1.4602345869e-007
11.71875;-69.8254675324;131.103658034	-8189;-2.73310834602e-007
14.6484375;-76.1489305361;90.1415173229	-8188;3.75723148163e-007
17.578125;-79.5758727592;157.60608961	-8187;-2.00377491522e-007
20.5078125;-65.3711177742;-167.647698387	-8186;6.96526195308e-008
23.4375;-59.0231536476;154.266571843	-8185;-2.26586327537e-007
26.3671875;-57.0922084688;117.572042643	-8184;2.88144984314e-007
	v

Export response to file Filename Im Files (x86)\HX Audio Lab\Filter Hose V2.0 Beta Test 2	HolmTest.txt
Frequency Impulse Text Options Impulse Text Options Comment start character(s): # Column separator • • : (Semicolon) • Space • .(Comma) • Decimal separator • .(Dot) • • .(Dot) • .(Comma)	Browse

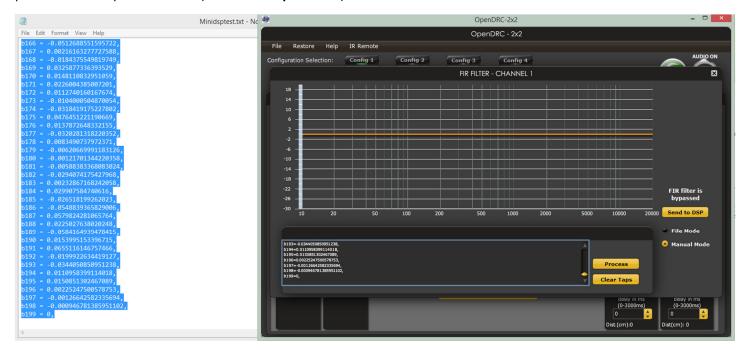
Export to MiniDSP

Filter Hose is able to export coefficient to MiniDSP OpenDRC plugin.

Right-click on the time-domain filter graph and select Export Text (MiniDSP).



Open the text file in Notepad; copy all text to MiniDSP input. Please make sure that MiniDSP is in manual mode and its previous filter taps are cleared (click **Clear Taps** button).



Click Process and Send to DSP.



Example: Importing a Filter Transfer Function (Time Domain Data Input)

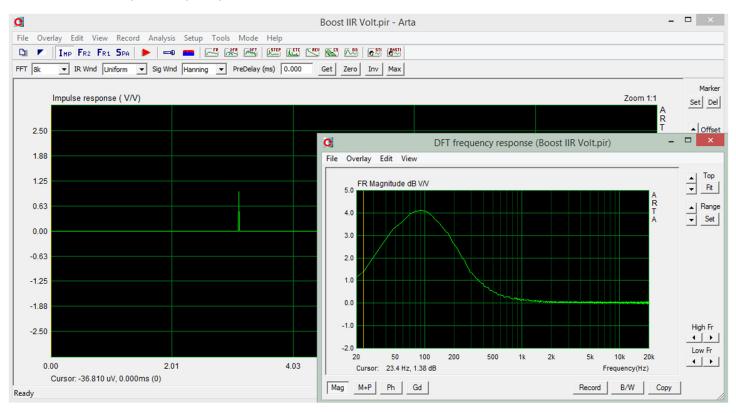
General Information

In Filter Hose v1.2 and higher, it is possible to import a .csv file in step one or step two. Step one will import .csv file and will extend the length to the next 2ⁿ value or more. Sample rate will be asked when a .csv file is loaded. Step two will import .csv as is, assuming the sample rate matches the loaded measurement (step one).

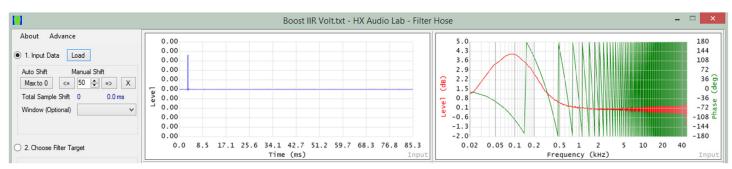
Loading a Filter Transfer Function Measurement

To load a filter transfer function measurement to Filter Hose, user can use a time domain data. This can be done by using a .csv/.txt format. Please follow the example below.

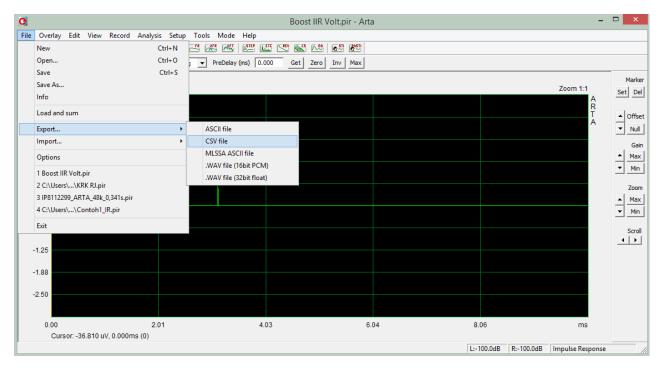
1. ARTA is used to measure a transfer function of a digital loudspeaker management system. The transfer function contains only low frequency boost centered at 90Hz as shown below.



2. When the filter is exported from ARTA, the ARTA .txt file contains frequency domain data. If it is loaded to Filter Hose under ARTA (.txt), it will result incorrect time domain data. Note the Y-axis is all 0.



3. To do this correctly, it is recommended to export the time domain data from ARTA as shown below.



4. Open the exported ARTA .csv file (time domain) and select the amplitude column only. Copy paste the value to a new .txt file (such as using NotePad) and then rename the .txt to .csv as shown below. Note: .csv is basically a .txt file format.

X	। 🔒 🐬 े	÷			Boost IIR Volt - Copy.csv - Notepad – 🗆 🗙	
F	ILE HOME	INSERT PAG	SE LAYOUT	FORMULAS	DA	
	ste 💉 B I	· · 11 · <u>⊔</u> · ⊞ · ,	• A A •	= = = %		-3.680991E-05 -1.235313E-04 -1.036747E-04 -1.975296E-04
Cli	pboard 🗔	Font	Fa	Alignme	nt	-6.990405E-05
B4	l .	* = ×	🗸 fx	-0.00003680	991	-1.617216E-04 -7.318192E-05
1	А	В	С	D	E	-1.941228E-04 -5.570718E-05
1	Numpoints	8192				-1.759638E-04
2	SamplingRate(H	96000				-1.317780E-04
3	Time(s)	Amplitude(V)				-8.188633E-05
4	0.00E+00	-3.680991E-05				-2.155502E-04
5	1.04E-05	-1.235313E-04				-1.009713E-04
6	2.08E-05	-1.036747E-04				-1.443152E-04
7	3.13E-05	-1.975290E-04				-1.191753E-04
8	4.17E-05	-6.990405E-05				-1.435096E-04
9	5.21E-05	-1.617216E-04				-9.599025E-05
10	6.25E-05	-7.318192E-05				-1.410400E-04 -1.252740E-04
11	7.29E-05	-1.941228E-04				-1.252740E-04 -2.141252E-05
12	8.33E-05	-5.570718E-05				-2.038459E-04
13	9.38E-05	-1.759638E-04				-4.880150E-05
14	1.04E-04	-1.317780E-04				-2.194888E-04
15	1.15E-04	-8.188633E-05				-1.092416E-04
16	1.25E-04	-2.155502E-04				-9.736702E-05
17	1.35E-04	-1.009713E-04				-1.466545E-04
18	1.46E-04	-1.443152E-04				-1.021172E-04
19	1.56E-04	-1.191753E-04				-5.159593E-05
20	1.67E-04	-1.435096E-04				-1.240588E-04 -5.400578E-05
21	1.77E-04					-8.434286E-05
22	1.88E-04					-1.077777E-04
23	1.98E-04					-9.952416E-05
24	2.08E-04	-2.141252E-05				-1.642912E-04
25	2.19E-04	-2.038459E-04				3.551286E-05
26	2.29E-04	-4.880150E-05				-2.267281E-04
						-1.587957E-05
	< → Bo	ost IIR Volt	(\bullet)			-1.475464E-04
RE/	ADY 🔠					-4.148173E-05 v

5. Use Load Filter (.csv) option from Filter Hose to open the filter, choose the appropriate sample rate and desired extended N. The graph below matches the graph shown under step 1 of this tutorial.

